NUEXCO

NOVEMBER 1986 NUMBER 219

MONTHLY REPORT

ON THE NUCLEAR FUEL MARKET

NUEXCO

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(See inside back cover for list of Representatives and Consultants.)

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MONTHLY REPORT ON THE NUCLEAR FUEL MARKET

November 1986 No. 219

R. WESLEY MILLER, *EDITOR* CLARK M. BEYER, *ASSOCIATE EDITOR*

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TO OUR READERS

To Our Readers

As part of its expanding international scope of activities, Nuexco is pleased to announce its association with a group of businessmen of international stature known to many in the nuclear industry. This group, still being expanded, is the International Advisory Committee to the Chief Executive Office of Nuexco; it also counsels with Nuexco's parent, Concord-Nuexco International Corporation, and its non-nuclear affiliates. Members of the committee directly participate in the providing of various Nuexco services, including merger and acquisition arrangements, major financing arrangements, and arbitration services, while counseling on unusual technical, business and political aspects of some of the current complex brokerage transactions. This distinguished group is led by Bob Wolcott as Chairman. Its relationship with Nuexco and its affiliates is coordinated by Wayne Fowler, and, as to nuclear and non-nuclear activities in Europe, by Don Ebright. The group meets regularly every few months, having met in Geneva in June during the Palexpo meetings of the AIF, and in London in September during the Uranium Institute meetings.

J. Robert (Bob) Wolcott

Mr. Wolcott, formerly Chairman of Nuexco, is a resident of California. He now serves as a Consultant to Nuexco and as Chairman of the Concord-Nuexco International Advisory Committee. Mr. Wolcott was employed by General Electric for over 20 years prior to 1968, including being manager of design for the Dresden 1 nuclear power station, G.E.'s first commercial venture in nuclear power. He also managed manufacturing, an electronics products section, and international functions.

T. J. (Tom) Barendregt

Dr. Barendregt, formerly President of Nucon B.V. nuclear engineering contractors in Amsterdam, is a resident of Blaricum, the Netherlands. Dr. Barendregt has, during the last 25 years, served as Director for the construction and operation of a reprocessing plant for irradiated fuels, EUROCHEMIC, in Mol, Belgium; Senior Manager of Comprmo B.V., petroleum and nuclear engineering contractors in Amsterdam; and President of, and subsequently a Consultant to, Nucon B.V. Dr. Barendregt has also served as Assessor Special de Presidente, Empresas Nucleares Brasileiras S.A. (NUCLEBRAS) in Rio de Janeiro, Brazil.

Leland O. Erdahl

Mr. Erdahl, formerly President and Chief Executive Officer of Ranchers Exploration and Development Corporation, is a resident of New Mexico. Mr. Erdahl was employed from 1957 to 1967 by the U.S. Atomic Energy Commission at Grand Junction, Colorado and Washington, D.C. in various capacities, including Director of the Finance and Budget Division and Chief of the Audit Planning and Program Branch. He subsequently was employed by United Nuclear Corporation in Santa Fe, New Mexico, and from 1970 to 1984 by Ranchers Exploration and Development Corporation.

Lars Halle

Mr. Halle, formerly President of ASEA-ATOM, is a resident of Stockholm, Sweden. He is a graduate of the Swedish Royal Institute of Technology in Stockholm. Mr. Halle served from 1948 to 1957 as Production Manager at the AD Ifoverken, from 1957 to 1963 in ASEA's Nuclear Power Department, and from 1964 to 1968 as President of ASEA's South Africa Pty in South Africa. Mr. Halle returned to Sweden in 1968 as Vice President of Cementa and from 1968 to 1984 served as President of ASEA-ATOM.

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O. J. C. (John) Runnalls

Dr. Runnalls, a resident of Toronto, Canada, worked for 20 years for Atomic Energy of Canada Ltd. until 1971, when he was appointed Senior Advisor, Uranium and Nuclear Energy in the Department of Energy, Mines and Resources in Ottawa. He also served for 5 years as Executive Vice President of Uranium Canada Ltd. Since 1979, he has been associated with his alma mater, the University of Toronto, and is presently Chairman of the Centre for Nuclear Engineering.

George J. Stathakis

Mr. Stathakis, formerly President and Chief Executive Officer of General Electric Trading Company, is a resident of New York. Mr. Stathakis has affiliated with Nuexco as a Consultant on international investment banking and will assist in several of Nuexco's service capabilities. He spent approximately 20 years in the nuclear power business with General Electric, where he became General Manager of the Atomic Power Equipment Project in 1967, and Vice President and General Manager of the Nuclear Energy Division from 1971 to 1977.

James C. C. Stewart

Mr. Stewart, formerly Managing Director, Production Group, for the United Kingdom Atomic Energy Authority (predecessor of British Nuclear Fuels plc), is a resident of London, England. Mr. Stewart, a physicist, has been involved in radar, nuclear weapons, nuclear power and various other businesses. He has also served on the Board of the United Kingdom Atomic Energy Authority and Central Electricity Generating Board. He was Chairman of the Radio-Chemical Centre, Emersham International (involved with radio isotopes), Deputy Chairman of Nuclear Power Company Ltd. (reactor design and construction), and Director of National Nuclear Corporation Ltd. (reactor design and construction). Mr. Stewart has served as a Consultant to Nuexco for several years.

W. Bryan Webster

Mr. Webster, after an early career from 1943 to 1947 in the Manhattan Project in Oak Ridge, Tennessee, was employed by General Electric for 35 years. Mr. Webster worked for 15 years in various positions of Project Management and for 12 years as General Manager of the Power Plants Projects Department, managing procurement, construction and startup of 30 domestic and international plants. Mr. Webster has been a consultant to General Electric and Nuexco and is a resident of California.

* * *

Nuexco will host a hospitality suite during the Atomic Industrial Forum's Annual Conference at the Washington Hilton in Washington, D.C., November 16-19. We look forward to seeing you there.

* * *

Our US offices will be closed for the Thanksgiving holiday on Thursday, November 27 and Friday, November 28. Our European offices will be open for business on those days.

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PRICING

NATURAL URANIUM AND SECONDARY MARKET CONVERSION

(All data as of October 31, 1986)

The **Exchange Value** is **$17.00** per pound U_3O_8, unchanged since last month. **Active supply** of natural uranium (concentrates and UF_6) for spot or near-term delivery totals **3,740,000** pounds U_3O_8 equivalent, down 310 thousand pounds since last month. The corresponding figure for **active demand** is **950,000** pounds, down 465 thousand pounds. The spot and near-term **supply-demand ratio** rose to **3.9:1.**

The *Current Market Data* section of this Report lists six natural uranium sales, involving approximately 1.0 million pounds equivalent U_3O_8. All of the transactions involved spot or near-term delivery, and all met the criteria for inclusion in the current Transaction Value calculation. Four of the transactions involved natural UF_6.

The **Transaction Value** is **$17.25** per pound U_3O_8, down $0.10 since last month. The calculation extends over a 3-month period and includes 13 transactions involving 2.4 million pounds equivalent U_3O_8.

The **UF_6 Value** is **$48.00** per kilogram U in UF_6, unchanged since last month.

The **Conversion Value** is **$1.90** per pound U in UF_6, unchanged since last month. Active supply of secondary market conversion services for delivery within three years totals 2.0 million pounds U as UF_6. Active demand totals 650 thousand pounds U as UF_6. No secondary market conversion transactions are reported.

The **Loan Rate** is **4 percent** per annum, unchanged. One loan transaction, involving 100 to 300 thousand pounds U_3O_8 equivalent, is reported.

* * *

The Exchange Value and UF_6 Value were unchanged this month, as the market for natural uranium continues to exhibit the same fundamental characteristics that have prevailed since June, when US District Court Judge Carrigan handed down his decision in the lawsuit involving three US producers and DOE. Since the Tenth Circuit Court of Appeals granted DOE's request for a stay of judgment pending appeal, and absent any decision on that appeal, most market participants have remained cautious. Discretionary buyers have been waiting for the emergence of a clearer picture of price trends, and sellers have been hoping to see a significant upward price movement.

In recent weeks, industry attention has shifted away from developments in Senator Domenici's draft legislation and DOE's proposed enrichment criteria (see Reports 215, 216 and 217, July-September 1986). The Domenici bill was not passed during the recently adjourned session of Congress, but parts of it may be reintroduced in 1987. By withholding funding for the implementation of five key sections, Congress effectively nullified the most controversial provisions of DOE's proposed enrichment criteria. (See page 23 of this Report). Therefore, market participants have refocussed their attention on the US producers' lawsuit against DOE. It has once again become the primary hope for a resolution of the uncertainty that pervades the market. Until the Appeals Court renders its judgment, that uncertainty probably will continue.

It is important to recognize that a decision, when rendered by the Tenth Circuit Court of Appeals, will *not necessarily* dispose of all the issues in the case. For example, the case could be remanded to Judge Carrigan for further findings or it could be appealed to the US Supreme Court (but only if the Supreme Court agreed to hear the appeal). It is still possible that the Appeals Court could issue a strong, definitive opinion, such that the Department of Justice would decide to pursue the issue no further. Despite that possibility, market participants should be prepared for any of several alternatives.

The current trends in the uranium market have created a number of conflicting pressures for buyers and sellers. Unlike coal or oil, uranium concentrates have the same energy content regardless of their origin, yet origin has become one of the most important considerations in uranium pricing. Not only does each country participating in the nuclear industry have its own political position with regard to uranium production, sales, purchases, or reprocessing, but some countries even have conflicting standards among different regions or companies. In the FRG, for example, the utility in Hamburg is prohibited by local government policy from buying Southern African uranium, while a utility in the more conservative southern part of the nation may prefer uranium of that origin because of its lack of end-use restrictions. Similarly, from the view of some utilities in the USA that have overseas enrichment contracts, US uranium will carry no premium value even if the Circuit Court rules in favor of the US producers.

US-origin uranium continues to command a premium relative to the current Exchange Value, despite the fact that no legal requirements are in effect that would force US utilities to buy or enrich only US material. A considerable amount of US-origin uranium has been sold to US utilities in the last five months through origin-swap mechanisms. The continuing availability of US-origin uranium through swaps has enabled buyers to remain firm in their unwillingness to pay US producers' substantially higher asking prices. Nevertheless, some US producers have made sales at or slightly above the $17.00 level. When the

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Appeals Court granted DOE's request for a stay, demand for US-origin material subsided. Several utilities had completed all their desired purchases of US-origin material; others stayed out of the market, awaiting a judicial resolution of the market uncertainity.

Canadian-origin concentrates and UF_6 continue to sell for prices near the Exchange Value and the UF_6 Value, respectively. However, prices often vary substantially, depending on the timing and location of deliveries. The Canadian government's upgrading policy still stands in the way of concentrate sales to many utilities, both in Europe and in the USA. When exceptions to that policy are granted, the cost of transporting concentrates to Europe may offset the discounts available for material delivered in North America.

South African and Namibian uranium have become politically unacceptable in the USA and several European countries. Thus, its value in the spot market is limited. However, some buyers in Europe and the Far East still accept Southern African uranium; in fact, some prefer it to Canadian, Australian, or US-origin material because of the lack of prior approval required for reprocessing or retransfer of that material.

* * *

The Conversion Value was unchanged this month, as the secondary market remained largely inactive. No transactions are reported this month, but as of the end of the month, one potential buyer of a large quantity of secondary market conversion services was evaluating offers from several sellers.

In mid-October, the Nuclear Regulatory Commission voted unanimously to authorize the restart of Sequoyah Fuels Corporation's UF_6 conversion plant in Gore, Oklahoma. The authorization is contingent upon certain conditions specified in an NRC order modifying the license for the plant. Among other conditions, an independent consultant must monitor operations at the plant and report to the NRC. The facility was shut down in January 1986 following an accident that killed one worker and injured several others. Several months ago, Sequoyah was given permission to resume deliveries of UF_6 from its stockpile and receive U_3O_8 shipments. Because of conversion overcapacity worldwide, the interruption at Sequoyah seemed to have little impact in the overall demand for UF_6, and any uncertainties regarding the future of Sequoyah's operation apparently had no effect on either the demand or price of secondary market conversion services. Nevertheless, the NRC action should relieve any pressure on utilities concerned about security of UF_6 supply.

* * *

ENRICHED URANIUM AND SWUS

The **SWU Value** as of October 31, 1986, is $78 per SWU, unchanged since last month. This refers to SWU at a tails assay of 0.30 weight-percent U^{235} and for delivery within one year. Three secondary market SWU transactions are reported this month, involving approximately 100 thousand SWU.

The three transactions reported this month generally cover the range of SWU opportunities available in today's secondary market. Decreasing quantities of DOE-origin virgin SWUs are still available in the range of $85 to $100 per SWU, and can be used to upgrade the enrichment assay of larger amounts of enriched product. SWUs contained in enriched product (usually at any of several common enrichment assay levels) are typically available in much larger quantities, and command prices between $72 and $80 per SWU.

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CURRENT MARKET DATA

October 31, 1986	Market Values	Active Supply[1] (thousands)	Active Demand[1] (thousands)
EXCHANGE VALUE	**$17.00** lb. U_3O_8	3,740	950
UF_6 VALUE	**$48.00** kgU		
CONVERSION VALUE	**$1.90** lb. U as UF_6	1,965	650
SWU VALUE 0.3 tails assay; delivery within one year	**$78** SWU		
LOAN RATE	**4%** /annum	0	0

	$/lb. U_3O_8	Millions of Pounds	Number of Transactions	Number of Months
TRANSACTION VALUE	**17.25**	2.4	13	3

[1]Supply and demand tables in *Current Market Data* section of this Report detail the numbers for each category.

DEFINITIONS

1. The **Exchange Value** is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the date indicated.
2. The **UF_6 Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of natural uranium hexafluoride could be concluded as of the date indicated.
3. The **Conversion Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the date indicated.
4. The **SWU Value** represents Nuexco's judgment of the price at which transactions for the sale of significant quantities of SWUs of stated origin for delivery in the specified time period could be concluded as of the date indicated.
5. The **Loan Rate** is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the date indicated.
6. The **Transaction Value** is a weighted average price of recent natural uranium sales transactions. The calculation is based on prices paid in:
   a. Transactions closed within the previous three-month period for which delivery is scheduled within one year of the transaction date;
   b. At least ten transactions;
   c. Transactions involving a sum total of at least 2 million pounds U_3O_8 equivalent.

   The sample time is extended as necessary to include these minima. Other currencies are converted to US dollars using conversion rates in effect on or near the transaction date.

DERIVATIONS AND COMMENTS

1. All Market Values are based on:
   a. Data from recently completed transactions;
   b. Data from pending transactions;
   c. Firm bids to buy or borrow, and firm offers to sell or lend;
   d. Prices purchasers or rates borrowers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy or borrow, and prices sellers or rates lenders have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell or lend.
2. Prices associated with deliveries under old or renegotiated contracts or other than arm's-length transactions are not included in the determination of these Market Values.
3. In the determination of the Conversion Value, Nuexco does not consider transportation charges other than those customarily provided by primary suppliers of conversion services.
4. The prices of conversion services or SWUs delivered under long-term contracts with primary suppliers are not considered in the determination of either the Conversion Value or SWU Value.
5. For the SWU Value, Nuexco converts SWU prices at varying tails and product assays to equivalent SWU prices at a tails assay of 0.30 weight-percent U^{235} and a product assay of 3.0 weight-percent U^{235}, assuming feed costs corresponding to the Nuexco Exchange and Conversion Values determined as of the same date.
6. In calculating the Transaction Value, Nuexco does not account for the price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of future Exchange Values or any other indeterminate variable. Also excluded from the calculation are any other transactions in which the delivery price is defined in such a way that it cannot currently be determined.

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EXCHANGE VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	per lb. U_3O_8 in Concentrates			per kg. U in Concentrates		
	This Month (Oct 31, 1986)	Last Month (Sep 30, 1986)	12 Months Ago (Oct 31, 1985)	This Month (Oct 31, 1986)	Last Month (Sep 30, 1986)	12 Months Ago (Oct 31, 1985)
Australia (dollar)	26.46	27.06	23.51	68.79	70.34	61.13
Belgium (comm. franc)	724.95	714.29	873.94	1,885	1,857	2,272
Canada (dollar)	23.61	23.58	22.55	61.38	61.32	58.63
Finland (markka)	84.75	83.37	92.54	220.32	216.75	240.59
France (franc)	113.86	112.29	132.32	296.02	291.92	344.00
FRG (mark)	34.85	34.32	43.43	90.60	89.21	112.91
Italy (lira)	24,107	23,800	29,188	62,672	61,873	75,882
Japan (yen)	2,742	2,608	3,507	7,128	6,780	9,119
Netherlands (guilder)	39.43	38.90	48.79	102.52	101.14	126.84
South Africa (rand)	38.64	37.53	42.04	100.45	97.56	109.29
Spain (peseta)	2,334	2,269	2,647	6,068	5,900	6,883
Sweden (krona)	119.13	117.48	129.62	309.71	305.43	336.97
Switzerland (franc)	28.90	27.81	35.56	75.14	72.31	92.45
UK (pound)	12.12	11.85	11.51	31.51	30.80	29.91
US (dollar)	17.00	17.00	16.50	44.20	44.20	42.90

TRANSACTION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	per lb. U_3O_8 in Concentrates			per kg. U in Concentrates		
	This Month (Oct 31, 1986)	Last Month (Sep 30, 1986)	12 Months Ago (Oct 31, 1985)	This Month (Oct 31, 1986)	Last Month (Sep 30, 1986)	12 Months Ago (Oct 31, 1985)
Australia (dollar)	26.85	27.61	22.45	69.80	71.79	58.35
Belgium (comm. franc)	735.61	728.99	834.22	1,912	1,895	2,168
Canada (dollar)	23.96	24.07	21.53	62.28	62.58	55.97
Finland (markka)	85.99	85.09	88.33	223.56	221.22	229.65
France (franc)	115.54	114.60	126.30	300.38	297.93	328.36
FRG (mark)	35.36	35.02	41.46	91.94	91.05	107.78
Italy (lira)	24,461	24,290	27,861	63,594	63,147	72,433
Japan (yen)	2,782	2,661	3,348	7,233	6,919	8,704
Netherlands (guilder)	40.01	39.70	46.57	104.03	103.22	121.07
South Africa (rand)	39.20	38.30	40.13	101.92	99.57	104.32
Spain (peseta)	2,369	2,316	2,527	6,158	6,021	6,570
Sweden (krona)	120.88	119.90	123.72	314.27	311.72	321.65
Switzerland (franc)	29.33	28.39	33.94	76.24	73.80	88.25
UK (pound)	12.30	12.09	10.98	31.97	31.43	28.55
US (dollar)	17.25	17.35	15.75	44.85	45.11	40.95

[1]Calculated using currency exchange rates published in the *Wall Street Journal* on Oct. 31, 1986.

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CURRENT MARKET DATA

CONVERSION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	per lb. U as UF_6			per kg. U as UF_6		
	This Month (Oct 31, 1986)	Last Month (Sep 30, 1986)	12 Months Ago (Oct 31, 1985)	This Month (Oct 31, 1986)	Last Month (Sep 30, 1986)	12 Months Ago (Oct 31, 1985)
Australia (dollar)	2.96	3.02	2.28	6.52	6.67	5.03
Belgium (comm. franc)	81.02	79.83	84.75	178.63	176.00	186.83
Canada (dollar)	2.64	2.64	2.19	5.82	5.81	4.82
Finland (markka)	9.47	9.32	8.97	20.88	20.54	19.78
France (franc)	12.73	12.55	12.83	28.06	27.67	28.29
FRG (mark)	3.90	3.84	4.21	8.59	8.46	9.29
Italy (lira)	2,694	2,660	2,830	5,940	5,864	6,239
Japan (yen)	306.45	291.46	340.14	675.61	642.55	749.87
Netherlands (guilder)	4.41	4.35	4.73	9.72	9.59	10.43
South Africa (rand)	4.32	4.19	4.08	9.52	9.25	8.99
Spain (peseta)	260.88	253.64	256.74	575.14	559.17	566.01
Sweden (krona)	13.31	13.13	12.57	29.35	28.95	27.71
Switzerland (franc)	3.23	3.11	3.45	7.12	6.85	7.60
UK (pound)	1.35	1.32	1.12	2.99	2.92	2.46
US (dollar)	1.90	1.90	1.60	4.19	4.19	3.53

SWU VALUE AND UF_6 VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	SWU Value delivery within one year (Oct 31, 1986)	UF_6 Value per kg.U in UF_6 This Month (Oct 31, 1986)	UF_6 Value per kg.U in UF_6 Last Month (Sep 30, 1986)
Australia (dollar)	121.40	74.71	76.40
Belgium (comm. franc)	3,326	2,047	2,017
Canada (dollar)	108.32	66.66	66.59
Finland (markka)	388.83	239.28	235.41
France (franc)	522.44	321.50	317.04
FRG (mark)	159.90	98.40	96.89
Italy (lira)	110,607	68,066	67,199
Japan (yen)	12,581	7,742	7,363
Netherlands (guilder)	180.93	111.34	109.84
South Africa (rand)	177.27	109.09	105.96
Spain (peseta)	10,710	6,591	6,408
Sweden (krona)	546.60	336.37	331.72
Switzerland (franc)	132.61	81.60	78.53
UK (pound)	55.60	34.22	33.45
US (dollar)	78.00	48.00	48.00

[1]Calculated using currency exchange rates published in the *Wall Street Journal* on Oct. 31, 1986.

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RECENT TRANSACTIONS[1]

Uranium Sales

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U_3O_8 equivalent)	Approximate Price as Percent of Current Exchange or UF_6 Value	Seller	Buyer	Remarks
3848	1987	301-600	104	Producer	Utility	UF_6
3847	1986	50-100	102	Producer	Utility	US origin
3835	1987	50-100	108	R[5]	Utility	UF_6, US origin
3834	1987	101-300	108	Trader	Utility	UF_6, US origin
3825	1986	less than 50	100	Producer	Utility	
3822	1987	101-300	102	Trader	Utility	UF_6

Loan Transactions

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U_3O_8 equivalent)	Approximate Price as Percent of Current Exchange or UF_6 Value	Seller	Borrower	Remarks
3811	1986	101-300	R[5]	Utility	Producer	

Enrichment Services
Secondary Market Sales

Nuexco Transaction Number	Delivery Period	Approximate Quantity[2] (thousands of SWUs)	Approximate Price[3] as Percent of Current SWU Value[4]	Seller	Buyer	SWU Origin	Remarks
3846	1987	less than 50	less than 92	R[5]	Utility	R[5]	
3843	1987	less than 50	105-106	Trader	Utility	DOE	
3842	1987	50-100	101	Trader	R[5]	DOE	

[1]Transactions listed are not limited to those in which Nuexco was involved, but also include others of which Nuexco is aware.
[2]If tails assay is unknown or unspecified, Nuexco's calculation of SWU quantity assumes 0.20 w/o tails assay.
[3]Price is not normalized to 0.20% tails assay.
[4]Refers to SWU Value that corresponds to SWUs included in transaction. When prices and SWU values are expressed as discounts (e.g., the X dollars less than DOE's USEC base price at time of delivery), the percentage refers to the ratio of the *discounts*, not the ratio of the prices.
[5]The notation *R* means that Nuexco either does not know, or that Nuexco has restricted that information to protect client confidentiality.

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CURRENT MARKET DATA

URANIUM SUPPLY
(October 31, 1986)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Spot or Near-term[2]	Intermediate or long term	Remarks
Available for Sale:			
ACTIVE			
2335	400	—	
2740	100	—	
2764	260	—	UF_6
2777	500	—	
2880*	100	—	
2885B	325	—	UF_6
2933	300	300 per year	1988-90
2967	200	—	
2973	15	—	
2989	40	—	
3023	500	500	UF_6
3121*	500	—	
3129*	500	500	
2263	—	400 per year	1988 on
2625	—	500 per year	1988 on
2781	—	250 per year	1988-95
2927	—	220 per year	1988-90
2981	—	600 per year	1988-91
TOTAL:	3,740		
INACTIVE			
2297	200	200 per year	1988-89
2336	250	250 per year	1988-94
2389	75	75 per year	1988-90
TOTAL:	525		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 2889, 3127.

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URANIUM DEMAND
(October 31, 1986)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Spot or Near-term[2]	Intermediate or long-term	Remarks
Inquiries to Purchase:			
ACTIVE			
2893*	200	—	UF_6
2948	100	—	UF_6
2954*	50		
2956*	350	350	U_3O_8 or UF_6
2962*	250		
2738	—	1,000	1989 on
2739	—	1,000 per year	1987-90
2962*	—	500	1989 on
3019*	—	200 per year	1988-91
TOTAL:	950		
INACTIVE			
2760	750	750 per year	1988-90
2798	70	—	
2681	—	500	UF_6 or U_3O_8; 1988
2936	—	400 per year	1988-95
TOTAL:	820		

*New or revised since last month.
[1]Measured from the date of this Report.
[2]For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.
Projects removed since last month: 2782, 2784, 2877, 2955.

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CURRENT MARKET DATA

LOAN SUPPLY AND DEMAND
(October 31, 1986)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Within 1 Year	Beyond 1 Year	Remarks
Available for Loan:			
INACTIVE			
1938	2,000	—	UF_6
2036	500	—	
2667	800	—	
2920	2,000	—	
TOTAL:	5,300		

*New or revised since last month.
[1]Measured from the date of this Report.
Projects removed since last month: None.

No inquiries to borrow are reported this month.

CONVERSION SUPPLY AND DEMAND
(October 31, 1986)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U as UF_6) Within 3 Years	Beyond 3 Years	Remarks
Available for Sale:			
ACTIVE			
2849	550	500	1987-90
2859	750	750	
2935	500	—	
2988	165	—	
TOTAL:	1,965		
Inquiries to Purchase:			
ACTIVE			
2833	400	—	
2949	250	—	
TOTAL:	650		

*New or revised since last month.
[1]Measured from the date of this Report.
Projects removed since last month: None.

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SWU SUPPLY AND DEMAND
(October 31, 1986)

Nuexco Project Number	Delivery Period[1] (Thousands of SWUs) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Available for Sale:			
ACTIVE			
2571	—	55	1987
2855	250	—	
2957*	10	—	
TOTAL:	260		
Inquiries to Purchase:			
INACTIVE			
2854*	130	—	
2878	60	—	
2879	250	—	
2999	—	300	
2968*	10	—	
3015	85	—	
TOTAL:	535		

*New or revised since last month.
[1]Measured from the date of this Report.
[2]For delivery within one year. This category excludes SWU's deliverable within one year under other than spot or near-term contracts.
Projects removed since last month: 2410, 2873, 2923, 2953.

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NUEXCO

ANALYSIS & COMMENTARY

EFFECTS OF THE CHERNOBYL ACCIDENT ON WORLDWIDE NUCLEAR POWER PROGRAMS

Introduction

The April 1986 accident at Chernobyl in the USSR has already had a considerable effect on some nuclear power programs throughout the world. During the six months since the accident occurred, many countries have been reexamining their plans for nuclear power development. In several countries there have been postponements of decisions to order new nuclear plants, and early decommissioning of reactors has become a topic of discussion. The strongest reactions to the Soviet accident took place in Western Europe. Considering that region's proximity to the radioactive release from the Soviet plant, and the influence of historically anti-nuclear environmental movements in several countries, such reactions were predictable.

The political positions taken against further nuclear expansion have generally reflected the negative shift in public attitudes toward nuclear power in Western Europe. Because of the highly negative publicity, also, most pro-nuclear politicians have remained quiet, waiting until a more reasoned discussion of nuclear issues can take place. Much of the public and media alarm over nuclear power following the Chernobyl accident has diminished with the passage of time, and earlier emotional reactions have slowly changed into a more rational outlook. Most of the projects or facilities that have been targets of protest or political activity since the Soviet disaster had been controversial prior to that event.

The following examples briefly summarize the varying reactions to Chernobyl.

1. The Federal Republic of Germany (FRG), Sweden, Finland, the Netherlands, Italy, and Austria have all experienced strong negative public reactions to the Chernobyl accident. The FRG and Sweden now appear to have suffered little damage to their nuclear programs despite intense political activity. Nuclear programs in Finland, the Netherlands, Italy, and Austria face the possibility of: (1) cancellations of planned nuclear plants; (2) shutdowns of units under construction; or (3) closures of completed facilities.

2. Spain, Yugoslavia, and Taiwan have postponed decisions on plans for future reactors.

3. The United Kingdom and Brazil have engaged in heated debates over their nuclear plans, but no firm decisions have been made.

4. France, Belgium, Japan, South Korea, and India all stress that their commitments to nuclear power remain firm.

5. The countries of Eastern Europe, along with the Soviet Union, continue to plan for rapid expansion of nuclear power.

Outside Europe, few changes in either nuclear planning or nuclear plant operations have resulted directly from the accident at Chernobyl, although some actions that might have taken place anyway have been attributed to it. However, virtually all countries with nuclear industries have initiated safety studies of various kinds, examining technical aspects of plant design and public disaster planning. But in sum, the negative consequences of the Chernobyl accident appear to affect the worldwide nuclear industry primarily in the areas of actual or potential deferrals of orders for new plants.

In general, repercussions from the accident at Chernobyl can be divided into the technical and the social-political areas. Nuclear physicists, engineers and other technical experts are examining the reports issued by the Soviet Union, as they analyze the causes of the accident. Since that event, reactor manufacturers and utilities in the West have spent much time and energy to reassure the public that safety standards in force outside of the Soviet Union are much more strict, emphasizing essential differences in Western reactor designs and safety systems.

In countries where opponents of nuclear energy have enough power to influence policy, the reaction to Chernobyl may affect operating nuclear plants, units still under construction, or those in the planning stage. Whether any currently operating power plants will be closed because of the political response will probably depend on the results of upcoming elections, as well as on serious studies of the alternatives to nuclear power generation.

Although political reactions to the Chernobyl accident have been dramatic, in most cases they have been less negative than they appeared at first, considering the scope of the damage and the effect of radioactive fallout on nearby countries. In many cases, decisions about orders for future plants have been postponed until after the completion of studies aimed at reexamining reactor designs and safety systems, as well as the sizes of evacuation zones and other disaster planning measures.

The following sections discuss in more detail some of the effects of the accident at Chernobyl on the international nuclear industry.

Western Europe

Since the late 1970s, the **Federal Republic of Germany** (FRG) has experienced a great deal of political controversy over nuclear power. Activists opposed to nuclear power are well organized in the FRG, and virtually all the nuclear installations that have been the targets of political pressure or public demonstrations after Chernobyl had also experienced active opposition before the Soviet accident. The Brokdorf nuclear power station,

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for example, was the site of violent demonstrations during the 1970s. This facility, on the River Elbe, is the first new unit in the FRG to come into operation since the accident at Chernobyl.

The two main opposition parties in West German politics, the Social Democratic Party (SPD) and the Green Party, have strengthened their stands against nuclear power since the Chernobyl accident. The Greens now call for an immediate, permanent, nationwide shutdown of all nuclear power plants. The SPD, a party that in some states depends on the Greens for a coalition majority, advocates withdrawing from nuclear power generation over a ten-year period. The SPD has traditionally opposed technologies that produce or process plutonium to a much greater extent than they have opposed basic nuclear power. Their opposition to any nuclear power generation has emerged only since the Chernobyl accident, and could be a short-term political response to the public's concern over the safety of nuclear plants.

The ruling national coalition of the Christian Democratic Union (CDU) and the Christian Socialist Union (CSU) reacted to the Soviet disaster by creating a new Cabinet post, Minister for the Environment and Nuclear Safety. The Minister, Walter Wallmann, is thought to have been chosen by conservative interests to placate the opposition. One of the Minister's first official actions was to initiate a study of reactor safety. Political analysts in the FRG closely watched the parliamentary elections held in June in Lower Saxony, traditionally considered a conservative state. Coming so soon after the Chernobyl accident, the election showed some erosion in the majority held by the Christian Democratic Union party, but the SPD and the Green Party alliance failed to gain enough seats to take power.

In the state of Hesse, the Green Party has been applying pressure on the state government to phase out all nuclear power in that state. The Green Party has a minority political presence with the SPD in that state's coalition government, but the Green's cooperation is needed by the SPD to maintain their coalition majority. Two 1300-MWe PWRs at Biblis, and a fuel fabrication plant in Hanau, are located in Hesse. Controversy over the Biblis-A unit, a 1200-MWe PWR in operation since 1974, has intensified since the federal government's Environment and Nuclear Safety Minister announced that he has asked the International Atomic Energy Agency (IAEA) for an Operational Safety Review Team (OSART) to visit the Biblis plant and others. The coalition of the SPD and the Green Party maintains that an inspection by the IAEA would not be strict enough, as inspection teams do not make thorough evaluations of reactor design. The Green Party has said that it will withdraw from the coalition with the SPD if the SPD does not, by the end of this year, support the Green's intent to shut down the Biblis Unit-A plant.

In North-Rhine Westphalia, Economics Minister Reimut Jochimsen has pointed to studies made for his ministry that he says indicate serious and possibly unresolvable technical problems in the Kalkar fast breeder reactor. He has denied the necessary license for fuel loading and start-up operation. Jochimsen has long been highly critical of the Kalkar project, and as North-Rhine Westphalia's top licensing authority, his opinion and influence are significant. Political opponents, however, have accused Jochimsen of using his position to advance his Social Democratic Party's anti-nuclear posture. The extent to which the SPD can claim public support for its platform should become more evident after several state elections are held, and after the federal elections scheduled for January 1987.

In late June, West German border police in the state of Bavaria turned back Austrian anti-nuclear demonstrators heading for the site of the Wackersdorf reprocessing plant in Bavaria, which is in the preliminary stage of construction. This incident prompted a diplomatic exchange between the two countries that focused international attention on the facility. In July, the demonstrators were allowed to cross the border to participate in protests against the plant. In late 1985 Wackersdorf was the target of violent protests at the plant site. Elections held in Bavaria in early October returned the conservative Christian Social Union to power by a safe margin. Party leader Franz Josef Strauss continues to support construction of the Wackersdorf reprocessing plant. Critics want the Wackersdorf facility indefinitely postponed or canceled, even though earthmoving and heavy construction are underway at the site.

Austria's government recently announced its intention to sell off the assets of Gemeinschaft Kernkraftwerk Tullnerfeld's (GKT) Zwentendorf unit, a 742-MWe BWR that was completed in 1978 but never commissioned. In June 1986, a study by Bechtel Power Corporation examined the options for selling the plant, either in part or as a whole unit. The study concluded that financial losses would be so great, and the possibilities of a sale so slight, that the Austrian government would be better off simply closing the plant in the hope that a future shift in the political climate might allow the plant to begin operation. Since then, public opinion in Austria has swung firmly against nuclear power. While the Chernobyl accident had a strong impact on public opinion in Austria, any decision to abandon the Zwentendorf project can be blamed only partially on the disaster in the Soviet Union. In fact, until the mothballed plant is actually dismantled, a reversal of the decision is still possible, though unlikely.

In **Switzerland,** the Chernobyl accident has provoked an active debate in the news media and in Parliament. The end result, however, is little change in Switzerland's program. The debate in Parliament this October focused on the questions of a

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nuclear phase-out, and a moratorium on construction of the Kaiseraugst plant. Parliament rejected outright any proposal of a nuclear phase-out for Switzerland, but reached no decision on the ground-breaking for Kaiseraugst. The consensus in Parliament was a strong desire to continue with nuclear power.

It has been nearly 20 years since the first siting permit request for Kaiseraugst, and several local communities have asked the government for new assurances of the plant's safety, including evacuation planning and protective measures against radioactive emissions. The evaluation of bids for Kaiseraugst continues although the date for selection of a supplier has been postponed until mid-1987 to allow for a more thorough analysis of bids. Both the Goesgen and Kaiseraugst sites have been controversial since long before the accident at Chernobyl occurred. That event has, however, provided the catalyst for renewed protests against those projects.

Wanting to capitalize on the public reaction to the Chernobyl disaster, Swiss anti-nuclear activists are trying to gather the necessary signatures to call a national referendum that would place a moratorium on all nuclear planning and construction for ten years. This signature gathering, however, has been in progress ever since a similar referendum was defeated several years ago. Even if enough signatures are obtained, the government can take up to five years before putting the referendum to a vote. Past anti-nuclear referenda have been defeated, the last time by a vote of about 55 percent to 45 percent in September 1985. Even though news coverage of the Chernobyl accident was extensive, and anti-nuclear feeling among the Swiss public increased, it is possible that such proposals will again be defeated.

In **France,** the government's commitment to nuclear energy appears to be unshaken following the Chernobyl accident. However, public sensitivity to the nuclear issue has risen following the accident at the Soviet facility, and also after several recently announced incidents at French facilities. A poll conducted in October by the Gallup organization showed a significant decline in public confidence in nuclear power, with a majority of people expressing the opinion that France should not continue to build more reactors.

In late August, cooling water flooded lower levels of the Cattenom plant during fuel loading, delaying unit startup operation for an unknown period of time. Cattenom is located only about 15 kilometers from the borders of both Luxembourg and the German state of Saar, a region with a population of over one million within a 50 kilometer radius of the plant. While no radioactive emissions were involved, the news media certainly gave the incident extra attention because of the Chernobyl accident. Protestors demonstrated against the plant in June, and the German and Luxembourg governments took legal actions to block operation of Cattenom until detailed safety reviews could be completed. Protests against Cattenom may have intensified since the event at Chernobyl, but they began well before that. Despite the protests, Cattenom achieved criticality in late October 1985, and is expected to reach full power and be connected to the French electricity grid by the end of this year.

There has also been concern among the French public and media over the disclosure of an accident in 1984 at the Bugey Unit 5 PWR, following several equipment failures. Although the incident was not actually concealed, the handling of news about it gave the impression of having been deliberately suppressed, especially after the Chernobyl accident had sensitized the media to all nuclear-related matters. Also of concern to the public were an incident at the La Hague reprocessing plant, and the apparent reluctance of the French government to release data on atmospheric radiation levels in France immediately following the Chernobyl accident. Thus, while the overall public reaction in France has become more critical, the French commitment to nuclear energy is unchanged.

Belgium's nuclear program also appears relatively unaffected by the Chernobyl accident. Partly because Belgium shares France's confidence in nuclear energy, but also because Belgium has no new nuclear plants under construction, the Soviet disaster has had little real impact there. However, the possible ordering of an eighth unit tentatively planned for the Doel complex may be postponed for an indefinite time.

In the **Netherlands,** the government has taken a cautious approach to the nuclear question following the accident at Chernobyl. In January 1986, the government had decided to order two new nuclear plants. This decision was questioned, however, after the accident at Chernobyl. In May voters returned the Netherland's moderate-conservative coalition government to power, but the government's present attitude is to study the Soviet disaster, and to reevaluate the Netherland's nuclear future. Plans for the two new plants are now indefinitely deferred.

In **Italy,** the public reaction to Chernobyl has caused a probable withdrawal from the prospect of nuclear expansion in the future, both by Ente Nazionale per l'Energia Elettrica (ENEL), the Italian state-run utility, and by the voting public. It now appears that any expansion of nuclear power in Italy is unlikely for the near future. Parliament has scheduled a National Conference on Energy for late 1986 to reevaluate Italy's energy strategy after the Chernobyl mishap. Completion of the unit under construction at Montalto di Castro and the second unit at Trino Vercellese are now uncertain and future construction of planned PWRs in Lombardy and Puglia appears unlikely. ENEL has been actively exploring ways in which coal and natural gas can be used to meet Italy's future energy requirements.

The nuclear issue in Italy has become a sensitive part of political platforms. Italy's Radical and Green Parties have col-

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lected more than one million signatures, enough to call for a national referendum on Italy's nuclear future. It appears that this referendum will not be blocked by legal maneuvering in the court system, or by changes in the requirements for referenda. The proposed referendum lists the following three points that would be voted on.

1. Special financial incentives that make acceptance of nuclear plants more attractive to local authorities would be eliminated.

2. The power to choose nuclear sites would be placed in the hands of Parliament, rather than the present appointed committee.

3. The involvement of ENEL in international nuclear projects, such as fast breeder research and development, would be prohibited.

Although these issues themselves may not seem to provide clear choices for or against nuclear power, the proposed referendum is regarded as a politically realistic and accurate indicator of current public and political feeling.

Since the Chernobyl accident, Italy's Socialist and Communist parties have greatly increased the pressure to completely phase out nuclear power. (One of the protestors at a recent demonstration at Caorso, Italy's largest commercial nuclear facility, was Claudio Martelli, deputy to Socialist Party Prime Minister Craxi.) These parties propose decommissioning the Latina and Trino Vercellese nuclear plants, both 21 years old, and possibly also the newer BWR unit at Caorso. In general, there is now little political support in Italy for nuclear-generated electricity.

In the **United Kingdom,** the fate of the Central Electric Generating Board's (CEGB) Sizewell PWR is still very much undecided, awaiting the public inquiry report on the Sizewell application. Preliminary work on the project has been slowed to the absolute minimum while CEGB evaluates the possibility of building coal-fired power plants to replace the potentially lost capacity from Sizewell and other planned reactors. Critics have also focused attention on England's Magnox reactors. Approximately three-fourths of the UK's nuclear power generation comes from this group of reactors, which have an average age of approximately 20 years.

The age of the Magnox reactors and the uncertain outcome of a long-term safety review, initiated in 1979 following the discovery of material defects in some reactors, have made long-term planning for the future electricity production from these reactors difficult. The Chernobyl accident made it unlikely that the UK will be able to institute any program to extend the operating lifetimes of this group of reactors. In addition, the lack of secondary containment vessels over two of the early Magnox units, Berkeley and Bradwell, both placed in service in 1962, has made the public especially sensitive to design features that bear a similarity to the Chernobyl plant. Even before the accident in the Soviet Union, most of the government's political opposition was directed against additional nuclear construction. The Labour Party clearly opposes a nuclear future in Great Britain, calling for a phased withdrawal from all nuclear power within ten years.

The position of **Spain's** socialist government in opposing nuclear energy had been gradually shifting in favor of a renewed program before the Chernobyl accident. Spain's eight operating nuclear plants generated 30 percent of the country's electricity during the first half of 1986. Now, however, public sensitivity to nuclear power appears to have shifted against further reactor construction. Pending the results of a review of the national energy plan, the Spanish government has continued its suspension of construction of several nuclear plants being built. The most likely candidates for reconsideration are the Valdecaballeros units, in the province of Estremadura. Of these two 975 MWe BWRs, Unit 1 is approximately 70 percent complete, and Unit 2 is 60 percent complete.

The government of **Yugoslavia** responded to the Chernobyl accident by postponing, at least for the near term, decisions on the future construction of several nuclear plants long under consideration. The Republic of Croatia responded by removing plans for the Prevlaka 1000 MWe unit from its five-year economic development plan. Evidently, this removal does not actually take the power plant out of consideration, but allows the Croatian government to defer approval until after the tendering process has been completed and contractors chosen. Tenders from foreign and Yugoslav suppliers were submitted in June, and decisions are expected by mid-1987.

Government plans for the Prevlaka site ultimately include four reactors, that would be scheduled to begin commercial operations at the rate of one reactor per year between 2000 and 2003. Although such a schedule appears to be overly optimistic, Yugoslav engineering and fabrication companies hope to be providing nearly 100 percent of the expertise and material for the nation's nuclear power construction program by the time the third unit is complete. Yugoslavia now operates a single 664-MWe Westinghouse PWR at Krsko, near Zagreb.

Following the Chernobyl accident, public opposition to nuclear power increased a great deal in Yugoslavia, as the ban on Yugoslav food imports by EEC countries focused public awareness on nuclear issues. Immediately after the Soviet accident, polls showed three-fourths of the Yugoslav people against the construction of any new nuclear power stations, but the country's difficult energy choices and ambitious hopes for strong industrial development by the year 2000 may cause the current anti-nuclear sentiment to be short-lived.

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ANALYSIS & COMMENTARY

Scandinavia

In **Sweden,** the government has acknowledged the strong position of the nuclear opposition in that country, but has also tried to establish a rational economic framework for the withdrawal from nuclear power by the year 2010, presently mandated by law as a result of a referendum passed in 1980 and a subsequent vote in Parliament. A study ordered by Prime Minister Ingvar Carlsson will examine the various aspects of a possible closure of the Barsebaeck station, where two 600-MWe Asea-Atom BWRs were completed in 1975 and 1979. The study will be made by the Swedish Energy Council, which is made up of representatives from political parties, environmental groups, business, the utilities, and trade unions. Denmark has actively sought a shutdown of this reactor site since long before the Chernobyl accident. Barsebaeck is located only about 20 kilometers from Copenhagen. Even though the Swedish attitude against nuclear power has hardened, it appears unlikely that any operating plants will be shut down for decommissioning as a result of reaction to the Chernobyl disaster.

A proposal recently has been presented to Parliament that prohibits any preparation for building additional nuclear reactors in Sweden. Critics call this bill unnecessary, but it is likely to gain approval in Parliament, where several parties are competing to be considered the most anti-nuclear party. This bill, however, apparently has its roots from before the Chernobyl accident, coming from reports of reactor planning by Swedish utility OKG.

Following the Chernobyl accident, opinion polls in **Finland** showed strong public feeling against any futher nuclear expansion in that country. This reaction has created uncertainty about when or if a planned fifth and possibly sixth reactor will ever be ordered. Finland has maintained close ties to the Soviet Union and to the Soviet nuclear energy administration, and two of their four reactors were bought from the Soviet Union. The latest reports from Finland say that any nuclear plant orders are likely to be postponed until the mid-1990's. At present, it appears that coal could supply the majority of Finland's near-term energy needs. One Finnish state utility, Imatran Voima Oy (IVO), is reported to be considering several potential sites for coal-fired power plants.

Eastern Europe

In **Poland,** Parliament has reportedly been petitioned to stop construction on the Zarnowiec nuclear facility, after demonstrations attended by several thousand residents of Bialystok, a city near the site. Residents reportedly want the plant placed under IAEA supervision. The government has stressed that the four VVER-440 (PWR) reactors are of totally different design than the RBMK-1000 type at Chernobyl. Meanwhile, the government has reportedly chosen a site for Poland's second large nuclear complex, a sparsely populated site near Klepicz, in the Posnan region. The plans call for construction to begin in 1987, with a total eventual capacity of 4000 MWe.

Nuclear development in **Czechoslovakia** will continue unchanged, according to the Czech authorities. That country still plans a major expansion that would increase the share of nuclear generating power from 13.3 percent in 1985 to over 50 percent by the year 2000, as well as the development of a sizable engineering and manufacturing capability based on the Soviet VVER-440 design.

Activists in the **German Democratic Republic** (GDR) have submitted a call for a referendum that would halt nuclear construction. At issue are two 1000-MWe PWRs under construction at a site near Standal, in addition to the four 440-MWe PWRs near Lubmin.

In general, the governments of the countries in Eastern Europe state plainly their intention to continue with nuclear expansion plans. In most of these countries there is little organized opposition and few mechanisms to translate protest into policy change.

North America

In the **United States**, the Chernobyl accident does not appear to directly threaten US reactor operations. However, reaction to the Soviet disaster has focused attention on several nuclear issues:

1. Emergency preparedness and emergency planning zones (EPZ s). In past years, many in the US nuclear industry believed that the current 10-mile radius emergency planning zones were not only sufficient, but unnecessarily large. Prior to the Chernobyl accident, there was a movement to reevaluate the 10-mile zones, perhaps reducing the requirement to as little as two miles. At present there is little support for reducing the size of EPZs to less than 10 miles.

2. Types and designs of reactor containment structures. Since the Chernobyl accident, the types of containments used in various US reactor designs have become the focus of critical examination. Overall, the US nuclear industry has spent considerable time and effort to point out that pressure containment designs used on US reactors are adequate to ensure that radiation would not be released into the environment, even in the event of a core melt. However, the lack of containment structures at several non-commercial US reactors has attracted considerable criticism.

3. Reactors with design similarities to that of the Chernobyl reactor. Immediately after the Chernobyl accident, attention focused on the few reactors in the US with a graphite-moderated core design. The only commercial plant having a graphite core is

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the Fort St. Vrain high-temperature gas-cooled reactor, operated by Public Service Company of Colorado. However, the graphite core material is the only design similarity this plant bears to the RBMK-1000 type at Chernobyl. (Several other non-commercial graphite-core reactors are in operation in the USA, but these units are not under NRC regulation.)

4. The Price-Anderson legislation currently under review in Congress. Liability limits for nuclear plants in the USA have recently attracted considerable public attention. During the last session of Congress, committees in the House of Representatives and the Senate were unable to resolve nuclear plant liability issues that affect an extension of the Price-Anderson Act (see article on page 25), which expires in August 1987. Currently the limit stands at $665 million dollars per unit. Legislative activity during 1987 is likely to result in the liability limit being raised to approximately $6.5 billion. In July 1986, the General Accounting Office released a study commissioned for the purpose of clarifying the question of liability limits under the Price-Anderson Act. It examined several scenarios whereby a number of US nuclear plants experience hypothetical "severe" and "catastrophic" accidents. The study compared potential damages arising from an accident in the USA in relation to the Chernobyl accident.

Critics of nuclear power in the USA have used the wide publicity given the Chernobyl accident to renew antinuclear efforts in the USA. However, the industry-wide safety reviews and the modifications applied after the accident at Three Mile Island Unit 2 in 1979 may have reduced the impact of the Chernobyl accident on public perceptions of the US nuclear industry. In general, controversial projects have been under scrutiny since before the Chernobyl disaster, and the reaction to it is not likely to result in the cancellation or shutdown of those plants.

In **Canada,** the completion of the last two units of the 3,500 MWe Darlington facility in Ontario is not likely to be affected by the event in the Soviet Union. However, Atomic Energy of Canada Ltd. (AECL) has spent considerable effort reassuring the public about safety-related matters, and emphasizing the important safety advantages of Canada's CANDU design over that of the Chernobyl reactor. The government of Ontario has, however, now approved distribution of potassium iodide pills to workers and residents living near nuclear plants. The debate over official approval has been going on since 1983, but has intensified since the Soviet accident. In a separate development, Ontario Hydro has prepared a proposal to provide nuclear safety technology to the Soviet Union, including training simulators, robotic devices, control systems, and radiation detection devices.

Far East

Despite considerable public concern over nuclear safety and increased opposition to the nuclear industry in recent public opinion polls, the government of **Japan** still holds to its original planning targets of increasing Japan's nuclear program as fast as possible. Start of construction of the Rokkasho-mura reprocessing plant could be delayed, however, while technology transfer agreements are still being negotiated and while the site selection is again analyzed for safety criteria. If budget requests from MITI (the Ministry of International Trade and Industry) and the Science and Technology Agency (STA) are approved for the fiscal year starting April 1, 1987, nuclear power may even increase its share of the Japanese government budget by 2.7 percent. The proposed budget for safety in particular has been increased considerably, up 14.2 percent, including much improved accident-related response and monitoring measures. In particular, the specific budget for severe accident-related safety measures was increased by 27.3 percent following the Chernobyl accident. Overall, most nuclear-related budget items are scheduled to receive an increase in funding, including research and development, although restraints imposed by Prime Minister Nakasone have resulted in a delay of the 600-MWe heavy-water demonstration reactor and budget cuts in the Fugen prototype reactor. However, only the increased attention to safety planning can be attributed to the Chernobyl event. Japan's intention to continue its nuclear expansion is officially unchanged, although site licensing procedures for new plants may have been slowed somewhat by a stricter application of regulations in response to public opinion.

The event at Chernobyl had little negative effect on **South Korea,** as indicated by the country's continued progress in two areas.

1. Korea's KNU-6, located at Kori, began commercial operations in June 1986, and KNU-7 started two months later. At present, there are six completed plants and Korea Electric Power Company (KEPCO) expects to produce at least 40 percent of the country's electricity from nuclear power in 1987.

2. After evaluating bids from a number of foreign nuclear suppliers, Korea awarded the contract for Korea Nuclear Units (KNU) 11 and 12 to Combustion Engineering (CE) in the USA. One of the reasons given for the choice of CE was the relatively higher degree of technology transfer involved in CE's bid; Korea's commitment to the attainment of self-sufficiency in the nuclear fuel cycle made that factor very important in the decision process.

Korea can be expected to proceed with its current construction plans. At present, three PWRs are under construction and in addition, planning and possible orders for KNU-13 and 14

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are scheduled to take place in 1987. The pause in long-term nuclear planning in South Korea that has delayed planning and construction commitments for several more plants appears to be the result of revised projections in electricity demand, and not a response to the Chernobyl incident.

The long-delayed nuclear power plant in the **Philippines,** Philippines National Power Plant (PNPP Unit 1), is still the center of a political and public controversy. The plant's interest and construction costs are responsible for the largest single part of the Philippine's foreign debt, and are estimated to cost over $350,000 a day in interest alone. President Aquino supports a permanent closure of the facility, which has long been criticized for seismic and other safety-related matters. Now, following the Chernobyl accident, and mounting local opposition to nuclear power, the future of the plant and its operating license are again in question.

Taiwan has postponed at least until 1987 the planned reopening of tenders for its long-delayed units 7 and 8. Taiwan presently ranks third in the world in percentage of electricity produced from nuclear plants, with 53.1 percent in 1985. Although the postponement was partially attributable to the Chernobyl accident, it was at least equally the result of economic considerations. Nuclear power officials have decided to wait and add to a report that was being prepared on the state of nuclear power in Taiwan. This report's initial version has been reported by newspapers in Taipei to have been critical of the high cost of Taiwan's nuclear power strategy.

In the **People's Republic of China,** the reaction to the accident at Chernobyl has been difficult to determine. In March 1986, letters of intent were sent to the French reactor supplier Framatome to provide much of the plant hardware for the Daya Bay Project in Guangdong. Negotiations with joint-venture partner China Power & Light of Hong Kong have finally resulted in the September 1986 announcement of a signed agreement with Framatome, Electricite de France (EdF), and General Electric Co. of the UK. Since the Chernobyl accident, considerable public concern about the safety of nuclear power has arisen in Hong Kong, which is located only 55 kilometers from Daya Bay. Although that concern does not threaten the PRC's plans for its nuclear program, the Chinese authorities have begun a safety and environmental study, which they hope will calm the fears that have arisen in Hong Kong concerning plant safety and evacuation planning. The Ministry of Science and Technology in Beijing has also established a 25-member Safety Committee, authorized to oversee such areas as public safety policy, regulation, research, safety standards, and power plant supervision.

Other Countries

In **India,** government authorities stress that their commitment to a nuclear program is unchanged. Although they have called for studies to examine safety-related matters, India's largely domestic nuclear industry appears relatively unaffected by Chernobyl, despite several problems that have received media attention in recent months.

After the Chernobyl accident, **Greece** experienced considerable public concern over the increased levels of radiation received in that country. The government has reacted by dropping any plans to install nuclear facilities in that country. Whether this decision is directly related to the Soviet accident, however, or whether that event merely provided the catalyst is unclear. Instead, the government has announced that it will endorse a shift to a wind-power program for electricity production.

In **Egypt** the often delayed El-Dabaa reactor plan has again fallen behind in the bidding program, this time because of the Chernobyl accident and the perceived need for additional safety reviews that could lead to further requirements in plant design. The three bidders for this one or two-unit 900-MWe PWR order are consortia led by Kraftwerk Union, Framatome, and Westinghouse.

The controversy surrounding evacuation planning for **Brazil's** Angra Unit 1 plant, the only operating commercial nuclear reactor in Brazil, has intensified following the accident at Chernobyl. The restart of the plant, following an equipment failure in May, has been blocked by judicial proceedings that challenge the acceptability of evacuation plans for the nearby town of Angra Dos Reis. Brazilian government officials have tried to counter public concern by allocating funds to implement evacuation plans, and by promising to create a new government agency to oversee public safety matters. In mid-October 1986, however, the Federal Appeals Court in Brazil voted to allow the unit to restart. Full commercial operation of Angra Unit 1, brought on line in late 1984, remains behind schedule.

In spite of the Chernobyl disaster's effects on public opinion in Brazil, the government has decided to restart construction of Angra Unit 2, a partly completed Kraftwerk Union PWR, and has tentatively decided to keep in place plans for Angra Unit 3. The fate of Iguape Units 1 and 2, still under construction, is also in doubt.

There is little indication that the Chernobyl accident has affected **Argentina's** nuclear development. However, the country's slow economy and heavy debt situation have made low cost foreign financing of new nuclear plants a key issue. Argentina apparently wants to continue with plans to expand the role of nuclear power if financial obstacles can be overcome.

Brazil and Argentina have agreed to participate in a joint program in which each nation agrees to notify and assist the other in the event of a nuclear accident or radiological emergency. The Chernobyl accident appears not to have shaken either country's confidence in nuclear power, but it probably has contributed to a heightened awareness of safety and accident planning. Talks

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continue between Argentina and both the FRG and Canada concerning future orders of nuclear equipment.

Turkey's first venture in nuclear power, to be built at Akkuyu Bay on the Mediterranean, has been postponed, but not apparently by Chernobyl. Turkey's joint-venture negotiations with AECL of Canada have stalled over financing and other details rather than over safety concerns.

Startup of **Mexico's** Laguna Verde plant, Mexico's sole nuclear unit, has been long delayed, but is now expected early in 1987. Chernobyl has had less effect on the schedule than has Mexico's financial situation, particularly its large international debt. The Chernobyl accident has not played any significant role in the nuclear plans of either **Pakistan** or **South Africa.**

Conclusion

In most cases, present or future projects that have become centers of controversy after the Chernobyl accident were controversial long before that accident occurred. While Chernobyl has certainly had an impact, there have been few cases in which the Chernobyl accident has been the primary cause of a decision going against nuclear power. The Soviet disaster has, however, clearly limited the ability of many politicians to override or ignore their opponents on environmental issues. Particularly in some Western European nations, where governing majorities are created from fragile coalitions, the parties that oppose nuclear energy stand to gain in power to the extent that nuclear safety becomes a more important issue. Also, the nuclear debate after the Chernobyl accident has now affected many people who might not have been opposed to, or even very much aware of, nuclear issues. Generally, politicians who are pro-nuclear have been waiting quietly for the negative publicity to subside before trying to present their views.

The Chernobyl accident came at a time when reduced fossil fuel prices contributed to the feeling of having more energy options than were available only two or three years ago. This situation has allowed proponents of non-nuclear energy technologies to advance seemingly logical arguments in favor of non-nuclear alternatives. But the extent to which available nuclear-generated electricity acts to suppress demand for oil and coal, therefore holding down prices of these alternative fuels, has not yet been addressed carefully following the Chernobyl accident. As the economics are studied more thoroughly, the ease with which some politicians and parties advocate immediately shutting down nuclear power plants may well change.

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CHERNOBYL IN PERSPECTIVE

by
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Introduction

The far-reaching effects of the Chernobyl accident in the USSR have caused a great deal of controversy and anxiety worldwide, fueling the debate between pro and antinuclear interests. Observers have sought to learn as much as possible about the causes of the accident for a variety of reasons:

1. to establish how and why it happened;

2. to clarify what effects the accident had and will have on the world population, and

3. to examine what steps must be taken to prevent another accident.

Such a serious event understandably commanded international attention, but there has been little information presented by the news media that would place the exposures from the accident in perspective with risks to public health inherent in other means of power generation or everyday activities in the course of daily life. Unless the effects of the accident can be viewed in relation to other hazards, it will not be possible to make a balanced judgment about nuclear energy for electricity generation.

In the days immediately following the accident, few facts were available to the news media, and there were rumors that thousands of Soviet citizens had died. At that point, the international news media could do little more than report the various claims, although the USSR denied that widespread deaths had occurred. In time, it became evident that the initial reports of large numbers of fatalities were not true, but that there had been extensive contamination of the countryside surrounding the plant. Factual detail regarding the radiological conditions in the vicinity of the plant was limited, but radioactive fallout levels throughout western Europe were well documented. Understandably, those activity levels caused great concern to the citizens of western Europe and such information was widely publicized by the media. In fact, the exposures in western Europe were generally low, and much less than had been feared. However, the lack of concensus among national officials as to the interpretation of the inadequate data (in terms of meaningful or consistent exposure measurements) undoubtedly caused added confusion.

As a result, various antinuclear organizations throughout western Europe seized the opportunity to exploit the situation, aggressively pursuing their objectives to halt nuclear power programs and shut down nuclear plants. Many of those groups received inordinate amounts of publicity, usually without providing equal time or emphasis to those who tried to provide a more balanced view on the Chernobyl accident. A broad dissemination of a more balanced viewpoint could have done much to eliminate confusion and calm fears in the months following the accident.

Risks of Exposure

In late August, the USSR issued a detailed report on the accident before a group of experts in Vienna convening under the auspices of the International Atomic Energy Agency (IAEA). The symposium, involving the USSR, IAEA and nuclear industry scientists and engineers, has provided a wealth of information about the basic issues in the accident. From the data provided by the USSR, many conclusions have been reached regarding the causes of the accident and differences between the Chernobyl reactor type and those in operation in the West. However, there has been little information presented by the news media since the Vienna conference that would place the exposures from the accident in perspective with everyday risks to public health. In order to make a balanced judgment about nuclear energy, the effects of the accident must be viewed in relation to other hazards. This type of analysis does not diminish the seriousness of the Chernobyl accident, but can serve to minimize some of the overreaction fostered by a lack of balanced information.

The basic radiological exposures received or expected to be received by the Soviet population were taken from the official reports presented by the Soviet specialists at the IAEA meeting. Specific exposures received by people in western Europe will vary greatly as a function of meteorological conditions in the weeks following the accident (wind directions, amount of rainfall, etc.), time spent in open areas, differences in diets and eating habits, and the amount and source of imported foodstuffs. However, around the periphery of Europe, the total effective dose equivalent (EDE) *for the entire first year* after the accident, resulting from external, inhalation and ingestion exposure routes was calculated to be[1]:

— for adults, about 10 millirem;

— for children, about 25 millirem.

In the central portions of western Europe, the average EDE exposure results were calculated to be:

— for adults, about 60 millirem;

— for children, about 150 millirem.

Even in the more highly contaminated areas in the central portion of western Europe, the EDE exposure was calculated to be:

[1]*SOURCE:* World Health Organization (WHO) preliminary report, published in the September issue of *Nuclear Europe*.

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— for adults, about 130 millirem;
— for children, about 280 millirem.

In comparison, the average amount of radiation exposure received from natural background sources by a person living in a typically developed country at an elevation of about 1,500 to 2,000 meters (such as at Denver, Colorado) is about *250 millirem in a year.* Thus, on the average, the exposures received in western Europe over the first year after the accident at Chernobyl should be less than one would receive by living for one year in a high-altitude location.

To make another type of comparison, radiological exposure and medical effects of other, so-called "natural" causes of death, by cancer or other causes, have been extracted from Professor Bernard L. Cohen's publication, *Before It's Too Late — A Scientist's Case for Nuclear Energy.* The following data are limited to exposure predictions primarily for people in the immediate vicinity of the Chernobyl plant; similar data for other countries have not yet been formally presented. The exposure results for persons in other countries will be substantially lower due to the greater distances and lower concentrations of radioactive materials present from the accident. (This analysis disregards the large radiation exposures received by the personnel working in the Chernobyl plant and by the firemen who treated the resulting fires. Their exposures were excessive, resulting in about 32 fatalities to date.)

The Soviets report an estimated collective initial external exposure of 1.6 million rem to a group of about 114,000 civilians evacuated from areas around the Chernobyl plant. On the basis of the projection that an exposure of 8,000 rem to a large population group will eventually cause one extra death due to cancer, the above exposures would, over a lengthy period of time, equate to about 200 extra cancer fatalities. The Soviets concluded that for the target population group they could normally expect about 14,000 cancer fatalities over the next 70 years from "natural" causes. Thus, they estimate that the effects of radioactive fallout from Chernobyl might cause 280 cancer deaths in the affected group over and above those expected from other causes. That estimate of 280 extra deaths amounts to a two percent increase in the total expected cancer deaths for the target population group of 114,000.

The Soviets further concluded that for a larger group of citizens (75 million people), the collective dose during 1986 may be about nine million rem, and over the next 50 years, the collective dose may reach 30 million rem. By applying the same dose-to-cancer-fatality ratio as above, the 1986 exposure could eventually lead to about an extra 1,075 cancer cases; the 50-year exposure could result in an extra 3,625 cancer cases. By comparison, over about the same period, the Soviets estimate the natural frequency for cancer would lead to about 9.5 million cases. Thus, while not minimizing the seriousness of thousands of potential added deaths, the expected effects of Chernobyl on the population group involved would still be *less than 0.05 percent* of all cancer-related deaths.

Regarding exposures to the thyroid gland from radioactive iodine released by the accident, the Soviets calculate that the exposure may eventually result in about 1,500 extra cancer deaths, compared to 150,000 thyroid-related deaths from other causes over the same period. Thus, the Chernobyl effect is only about 1 percent of what would be expected normally.

In internal exposures following the accident, radioactive cesium is considered to carry the greatest risk of exposure arising from its presence in foodstuffs. From the ingestion of cesium, the Soviets calculate an exposure of about 200 million rem over the next 70 years. (Some US experts believe that this value may be high by a factor of ten from their interpretation of the fallout values.) However, this would lead to an increase of only about 0.4 percent in mortality rates arising from normal causes. Potential internal exposures from uptake of other radioactive isotopes in foodstuffs are not expected to exceed those from cesium, which is the chief cause of concern in this means of exposure.

The Risks in Perspective

In summary, estimates indicate that the number of additional deaths over the next 50 year period as a result of the Chernobyl accident could reach 10,000. That figure, while highly variable, is certainly disastrous, but is small compared to initial fears that deaths would number into the hundreds of thousands or even millions. For the rest of the world, the effects should only be a small fraction of 10,000. By comparision, in the USA alone, more than 10,000 people die prematurely *every year* from the effects of atmospheric pollution caused by the burning of coal for electricity generation, and at least 2,000 miners die each year from coal mining, transport of coal, or black-lung disease caused by coal mining.

To illustrate more graphically the magnitude of risk from a nuclear power plant or radiation, the loss in life expectancy (LLE) estimates probabilities of death associated with everyday activities. Those estimates are based on statistics applied to a large sample population. The LLE is the product of the probability of a risk to cause death, and the consequences in terms of lost life expectancy if it does cause death. For example, statistics indicate that in the USA an average 40-year-old male will live another 34.8 years, so if he takes a risk that has a one percent chance of being immediately fatal, it results in an LLE of $(0.01 \times 34.8) = 0.348$ years. Of course, this probability factor does not mean that he will die 0.348 years sooner as a result of taking this risk. Instead, if 1,000 males his age took this risk, one percent or 10 males might die immediately, having their

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lives shortened by 34.8 years, while the other 990 would not have their lives shortened at all by the consequences of their having taken the same risk. Hence, the *average* lost life expectancy for the 1,000 people would be 0.348 years (127 days) and 127 days is the LLE for that particular risk. Table 1 expands on this theory by projecting various large sample averages in terms of lost life expectancy.

Table 1

LOSS IN LIFE EXPECTANCY FOR VARIOUS ACTIVITIES[1] (Based on large sample averaging)

Activity of Risk	LLE in Days
Being male vs female	2,800
Being unmarried	2,000
Cigarette smoking (1 pack per day)	1,600
Being 30 lbs. overweight	900
Driving small cars vs. standard size	50
Increasing driving speed from 55 to 65 mph	40
Working in a nuclear plant (Western world design) for entire lifetime	12
Radiation effects on the 135,000 Soviet people living within about 25 miles of the Chernobyl plant	10
Airline crashes	1
Dam failures	0.5
Radiation effects of living within a few miles of a nuclear plant of Western design for entire lifetime	0.4
Radiation effects on 75 million Soviet people living within a 300 to 600 mile radius of Chernobyl	0.4

[1]*SOURCE: Before It's Too Late — A Scientist's Case for Nuclear Energy*, by Bernard L. Cohen.

Conclusion

In light of these statistical averages, and the potential for major loss of life due to natural disasters such as dam failures, earthquakes, and other catastrophes, to conclude that Chernobyl was unusually costly in terms of human lives lost would be grossly erroneous. It also would be erroneous to conclude that all nuclear power plants should be shut down immediately or phased out within a short time because of concern over the Chernobyl accident. Decisions as to the types of systems used to generate electric energy should not be based on which system may have a smaller probability for a catastrophic accident, but on the *total number* of people whose deaths may be attributed to operation of the system in question. Professor Cohen's treatise explains this principle:

> "Suppose there are two technologies, A and B, for producing a desired product, and that technology A causes one large accident per year in which 100 people are killed, and that technology B kills 1,000 people each year, one at a time and unnoticeably. If technology B is chosen to avoid the catastrophic accidents from technology A, 900 extra people die unnecessarily each year."

It is clear that since Chernobyl, the world population has been exposed to varying degrees of additional radiation. However, it is also evident that for most of the world, including western Europe, the additional exposure generally has remained within the natural range of variation. Moreover, alternative means of generation of large quantities of electricity (by coal, oil, gas or hydro) may have greater adverse impact on the environmental ecology and health of the world population than does nuclear power. Thus, nuclear power should remain a preferred means of electricity generation for the vast quantities of electricity required today and in the future.

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SOUTH AFRICA

Third-quarter 1986 uranium production from Chamber of Mines producers totaled 2,906,000 pounds U_3O_8, a slight increase over the second quarter of 1986 (Table 2). While total production remained steady, several producers experienced declines, especially Harmony, JMS (Free State Joint Metallurgical Scheme), and Randfontein. Offsetting those reductions, Buffelsfontein increased production over 20 percent from their low second-quarter figures. Production at Buffelsfontein had fallen during the second quarter due to lower ore yield. Harmony Gold Mining Company Ltd. closed its Virginia plant at the end of August 1986 because of declining uranium demand and prices.

As one example of the South African producers' view of today's uranium market, Mr. C. G. Knobbs, Chairman of Harmony, made the following remarks in his annual review dated 28 August, 1986:

"The mine's production of uranium oxide dropped by 49,800 kilograms (110,000 pounds U_3O_8) reflecting the effects of the lower grade ore being mined. Some long-term supply contracts expired during the previous year, and with only two principal contracts left and some spot transactions, sales for the year dropped by 138,000 kilograms (300,000 pounds) or 34 percent. Nevertheless the drop in the value of the rand against the US dollar resulted in only a 12 percent decline in revenue compared with the previous year."

"Looking ahead, although a major upward price movement cannot be anticipated, the potential for some gradual improvement does present itself. The massive readjustment in the strength of the US dollar during the 1985 financial year has lowered the spot price for natural uranium to its lowest point in five years in terms of Yen and Deutschmark, the currencies of the more important purchasers. This trend should encourage purchases and render less attractive the practice of inventory liquidation which led the downward spiral in prices in the recent past. Unless any new major sources of supply enter the market this should allow for some price improvement in the near term."

"Uranium sales revenue will increase somewhat in the coming year in filling long-term contractual arrangements. These contracted sales, together with the anticipated spot sales, will nevertheless be insufficient to justify the operation of both the Harmony and Virginia uranium plants. International sanctions against South African uranium can only exacerbate the position. Serious consideration must therefore be given to closing another plant. The Merriespruit uranium plant was closed in March 1984."

Table 2

REPUBLIC OF SOUTH AFRICA:
1986 URANIUM PRODUCTION[1]
(Thousands of pounds U_3O_8)

Operation	First Quarter 1986	Second Quarter 1986	Third Quarter 1986	Year to Date 1986
Buffelsfontein	353	300	362	1,015
Driefontein Consolidated	41	49	46	136
ERGO[2]	91	88	79	258
Harmony	231	211	171	382
Hartebeestfontein	238	264	267	769
JMS[3]	318	305	279	902
Randfontein	339	324	304	967
Stilfontein (Chemwes)	137	135	141	413
Vaal Reefs	1,082	1,069	1,107	3,258
Western Areas	155	147	150	452
TOTAL[4]	2,983	2,892	2,906	8,871

[1]Excludes Palabora Mining Company, which is not a member of the Chamber of Mines.
[2]ERGO = East Rand Gold and Uranium Company Ltd.
[3]JMS = Free State Joint Metallurgical Scheme.
[4]Columns may not add due to rounding.

SWITZERLAND

The debate over the future of nuclear power in Switzerland continued last month as the Swiss Parliament examined various resolutions concerning energy policy in general and nuclear power in particular, following the Chernobyl accident. Following extensive discussion, the lower chamber of the Federal Assembly defeated by a vote of 105 to 68 a motion to shut down all Swiss nuclear power stations. Concurrently, the upper chamber voted unanimously to commission a study by the executive branch and review its recommendation. The study will focus on the future of energy sources and the consequences of replacing nuclear power with other sources of electricity. Switzerland presently generates about 60 percent of its electricity from hydropower, and about 40 percent from nuclear power.

The voting in the lower chamber was split between the Social Democrats, who are opposed to nuclear energy, and the Radicals, Christian Democrats, and Liberals, who are generally in favor of nuclear power. After an in-depth discussion of energy policy, the assembly voted in favor of continuing Switzerland's nuclear power program, concluding that without nuclear power only three alternatives would be available to supply the energy needs of the country:

1. Conservation measures;

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2. Other sources of electricity generation;

3. Importing electricity from neighboring countries.

Substituting additional hydroelectric stations for the nuclear power plants would require damming many more rivers, which has become unpopular with the Swiss people. In addition, such a plan would place a greater reliance on hydropower than would be compatible with the Swiss desire for a well-distributed energy mix. The debilitating environmental effects of coal or oil-fired power stations, and the lack of those indigenous resources, make electrical generation from fossil fuels unpopular. Finally, Switzerland's desire for energy autonomy makes the importation of power from other countries an undesirable alternative.

The lower chamber also voted 101 to 72 to continue development of the Kaiseraugst nuclear power plant project. In March 1985, the government granted a general authorization to proceed with the project. However, the vote to continue development of Kaiseraugst does not preclude the possibility of a moratorium on construction imposed at a later date. Bid evaluation for the new plant is underway. The consortium that owns the project includes seven Swiss utilities, three Swiss industrial groups, the French utility Electricite de France, and two West German utilities, RWE and Badenwerk.

Ultimately, despite the vocal protests over nuclear energy following the Chernobyl accident, the Swiss Parliament's affirmation of the role of nuclear power in that country represents a positive signal for the future of European nuclear power programs.

UNITED STATES

The US Congress, in an unexpected move, failed to disapprove the new enrichment criteria that DOE proposed on July 24, 1986. Although separate joint resolutions were passed in the Senate and House of Representatives to disapprove the criteria, Congress was unable to attach the resolutions to any pending legislation. One resolution had been attached as an amendment to a virtually veto-proof debt reduction bill, but the bill was stripped of all amendments immediately prior to its passage.

However, Congress did succeed in effectively nullifying those sections of the new criteria that had caused the most controversy by passing a joint resolution with the following introduction:

"None of the funds provided in this joint resolution or in any other law may be used to implement the following provisions of the uranium enrichment criteria submitted to Congress on July 24, 1986."

In effect, the resolution provides for funding of the new criteria, *except* for five important sections. Those sections denied government funding (effectively making them difficult to implement) are the following.

1. "Section 762. 3, which specifies the permitted enrichment of source material of foreign origin for use in domestic utilization facilities."

2. "The third sentence of section 762.11 (pertaining to quantities and form of feed and product material), to the extent that it provides limitations on free choice of transaction tails assays from 0.2 to 0.3 w/o U_{235} or imposition of an additional charge for selections in that range." In other words, DOE must provide a free Variable Tails Assay Option (VTAO).

3. "Section 762.15 (pertaining to prior enrichment contracts), to the extent it might be construed to validate contract provisions permitting unrestricted delivery and enrichment of foreign-origin feed material after a final court decision requiring restriction(s)...or permitting imposition of additional charges" for the VTAO. In other words, DOE cannot implement this section in order to circumvent a court decision requiring foreign-origin uranium restrictions or a VTAO surcharge.

4. "Any portion of the criteria or provision in any contract which permits or results in a reduction of the amount of feed material otherwise required to be delivered to DOE by commercial customers as a result of the use of uranium from government stockpiles...", i.e., the practice of over-feeding from the DOE stockpile.

5. "Section 762.6 (*Recovery of Prior Unrecouped Government Costs*), insofar as it may convey a determination of the level of unrecouped costs that must be returned to the Treasury by the enrichment program, which determination shall be made by the Congress in future legislation." Thus, the issue of the size of DOE's enrichment debt will be postponed until Congress reviews it again, apparently in its next session, which begins in early 1987.

In essence, by withholding funding for those sections, Congress stripped the criteria of the most controversial provisions. Congress appears intent on studying the cost recovery issue further, rather than allowing DOE to establish prices and costs based on its determination of the enrichment debt. In effect, the Utility Services Enrichment Contract (USEC) was partially approved by the resolution, but those provisions of the contract relating to foreign-origin enrichment, the free VTAO, and overfeeding from the DOE stockpile were not approved. As far as the question of enrichment of foreign-origin uranium for US use, Congress specifically stated that the issue was to be decided entirely by the outcome of the DOE/US producers litigation, currently under appeal in the Tenth Circuit Court of Appeals:

"...foreign-origin uranium may be enriched for domestic use only until a final judgment or dismissal in the pending litigation that determines whether section 161(v) of the Atomic Energy Act requires restriction of enrichment of foreign-origin source material, in which case the criteria shall be amended to impose such

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restrictions, or such unrestricted enrichment may continue, whichever is consistent with the decision of this question in the pending litigation..."

Thus, Congress will not allow DOE to use the new criteria to circumvent the decision that will be made by the Tenth Circuit Court regarding restrictions of foreign-origin uranium. Moreover, Congress made it clear that its joint resolution should have no impact on the court's upcoming decision:

"No provision of this joint resolution or the July 24, 1986 criteria shall affect the merits of the legal position of any of the parties...in the pending litigation in the United States Court of Appeals for the Tenth Circuit..."

As to the aforementioned litigation, there were no developments during October. If a decision is made by the Circuit Court of Appeals that effectively upholds the District Court ruling in favor of the producers, DOE would have no further *right* of appeal. However, DOE could petition the US Supreme Court to review the case. At that point, such a review could be granted or denied by the Supreme Court.

* * *

An article in Report 214 (June 1986, page 16) outlined the terms of some proposed changes to Statement of Financial Accounting Standard No. 71, entitled, "Accounting for the Effects of Certain Types of Regulations." Nuexco has been and will continue following the developments in this issue, as changes in the accounting treatment of certain events such as disallowances and plant cost phase-ins for electric utilities could have a strong impact on future nuclear plant financing or on recovery of costs through ratemaking. Recently, the *Wall Street Journal* reported that the Financial Accounting Standards Board (FASB) approved in part a new accounting standard pertaining to utility accounting methods for disallowances and other ratemaking issues. However, when contacted by Nuexco, a spokesman for FASB stated that the Board was still considering the amendment to Standard No. 71 and the comments to its Exposure Draft, and that a decision might not be reached until December 1986.

CORRECTION

The article on the Olympic Dam Project in Report 218 (October 1986) stated that the development schedule for the project calls for annual production of 5.2 million pounds of U_3O_8. In actuality, the schedule calls for annual production of 2,000 metric tons U_3O_8, or *4.4* million pounds U_3O_8.

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FOCUS

THE PRICE-ANDERSON ACT

Introduction

During the recently adjourned session of the United States Congress, committees in both houses of Congress worked to produce draft versions of an extension to the Price-Anderson Act. Congress, however, did not vote on this bill before adjournment. The Act, passed by Congress in 1957 to ensure that victims would be compensated in the event of an accident involving a commercial nuclear reactor or its radioactive elements, basically provides for what is in effect a joint private sector and government insurance policy for US nuclear utilities. Unless amended and extended by Congress, it will expire on August 1, 1987. Even if no legislative action is taken by the expiration date, all commercial reactors under license by the NRC at that date will still be covered at the original limits. However, after the expiration date, any new commercial reactors would not be covered under the Price-Anderson Act's authority, and contractors and their subcontractors operating facilities for the Department of Energy (DOE) would no longer be covered upon termination of their contracts.

Current Status

The main provisions of the Price-Anderson Act are summarized below.

1. It provides for private insurance and an insurance-like fund that is to be used to satisfy claims for personal injury and property damages to the public arising from a nuclear accident at any commercial US nuclear reactor.

2. The insurance also covers accidents arising from transportation of nuclear fuel and waste to and from reactor sites, as well as storage of nuclear fuel and waste at reactor sites. In addition, coverage is provided for nuclear-related accidents occurring at DOE contract facilities.

3. Claims made in case of accidents are to be settled under a system separate from the various state civil tort systems, and compensation and awards can be paid more promptly, avoiding lengthy litigation in local courts.

4. Utilities operating commercial reactors rated at over 100 MWe are obligated to carry the maximum available private liability insurance, currently $160 million per reactor. In addition, if the ultimate liability exceeds the $160 million in coverage, utilities operating nuclear reactors have to contribute up to $5 million per reactor into a pooled fund to be used to defray the balance of the liability. For damages beyond the liability limit, Congress is authorized to consider the payment of additional funds by the US government.

Thus, under the terms of the Price-Anderson Act, liability may be shared collectively among operators of nuclear power plants. At present, the nuclear industry's overall liability limit (the total compensation fund available for a nuclear accident) stands at about $665 million. This figure is derived from the utility's private insurance coverage on the involved reactor ($160 million) together with the retrospective maximum premium of $5 million assessed to each operating reactor, assuming 101 operating reactors having over 100 megawatts rated capacity.

In a very general sense, the Price-Anderson Act is intended to provide a measure of financial protection from nuclear incidents occurring across a broad spectrum of activities, and not just from accidents occurring during generation of electric power from commercial nuclear plants. Nuclear materials in the form of nuclear fuels are included under the Act, whether being transported to or from a facility using them, or in storage at a facility. Byproduct material, such as high and low-level nuclear waste, is also covered during transportation and storage, as are special nuclear materials, such as radioisotopes used in medicine or medical research. The many different licensees and contractors who are authorized to conduct nuclear-related activities, such as agencies or laboratories operating research reactors, or facilities handling nuclear waste material, also come under the jurisdiction of the Price-Anderson Act.

Another important feature of the Act is the separation of its damage claims procedures from the tort (civil lawsuit) system. The Act provides a mechanism whereby lawsuits for personal injury or property damage shall be presented and settled independently of the local legal system. One aspect of this provision replaces the often short periods of time within which an injured party must pursue his claim as established by state statutes of limitation. The Act currently provides for a maximum 20 year statute of limitation. In general, the procedures under the Price-Anderson Act are designed so that claims will be settled more quickly and simply than by litigation under state tort law.

The most controversial provision of the Price-Anderson Act concerns the liability limit with respect to a nuclear accident. Presently, an operator cannot be held liable for damages beyond the total amount available in the insurance pool, or about $665 million. However, provisions of the Act require Congress to review those situations in which actual damages exceed the liability limit. Such a review could result in authorization of additional funds to be provided by the US government for accident victims. The liability limit has the effect of placing the assets of the public utility beyond the reach of persons with damage claims in excess of the insurance coverage. In the event of an accident in which damage claims exceed the liability limit, the operating company is able to protect most of its assets from lawsuits that might otherwise bankrupt the company.

Recent Actions

The Chernobyl accident substantially increased the public's perception of the total damages that might be caused by a nuclear

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reactor accident. Before the Chernobyl disaster occurred, estimates of probable damages caused by nuclear accidents tended to be considerably lower than they are now. The accident at Three-Mile Island Unit 2, for example, involved little off-site damage; i.e. damage of the type that would produce claims under the Price-Anderson Act. The Chernobyl accident, however, showed that an "extraordinary nuclear occurrence", the phrase used in the Act to describe an accident involving substantial off-site contamination and damage, can occur.

In July 1986, the General Accounting Office released a study that estimated a range of damages that could result from a catastrophic accident at a US nuclear reactor. The study estimated off-site damages at several reactor sites at between $300,000,000 and $15,000,000,000. Using those figures the study indicated that the probable damages at a majority of US reactors would be about $6 billion. Using the study's estimates and the current $665 million limit, only about 4 percent of operating plants would be considered as fully covered by Price-Anderson funds.

The debate over the Price-Anderson Act has been extensively reported for the last few months, as different versions of legislation have been written in five separate Congressional committees. In the House of Representatives, the Energy and Commerce Committee, the Interior and Insular Affairs Committee, and the Science and Technology Committee have all worked on the bill. In the Senate, the Energy and Natural Resources Committee and the Environment and Public Works Committee have also produced drafts of an extension. During the next session of Congress, certain compromises will have to be reached on the several issues still dividing legislators in the various committees if an extension is to become law.

Key Issues

1. *Liability limits:* It is likely that the liability limits will be increased when the Price-Anderson Act is eventually amended and extended. In Congressional debate, limits discussed have ranged from about $2.5 billion up to a removal of all limits on liability. Realistically, the limit probably will be raised to a level between $5 and $6.5 billion. Any provision that allowed unlimited liability would be unacceptable to the nuclear industry, which only reluctantly supports a proposal for a limit in the range of $2-3 billion. Raising the liability limit to $6.5 billion would set each 100-plus megawatt reactor's total liability for retrospective premiums at about $63 million per accident, instead of the current $5 million. Under Representative Morris Udall's proposed compromise, the $63 million premium would be paid in annual installments not to exceed $10 million per year. In addition, increased primary private insurance coverage up to amounts available from the insurance industry (estimated at $200 million) might be required (up from the present figure of $160 million).

2. *Plant operators vs. DOE licensees:* Utility companies operating reactors and contractors to the Department of Energy represent different parts of the liability problem. DOE contracts with operators at four major research facilities — Los Alamos National Laboratory, the Hanford Reservation, Lawrence Berkeley Laboratory, and Lawrence Livermore National Laboratory — expire at the end of September 1987. Without the coverage provided by the Price-Anderson Act, contract negotiations at these and other DOE facilities could be difficult. In one proposed version of the extended Act, the first $6.5 billion in damages incurred by DOE contractors would be paid from the nuclear waste fund, with no limit to the federal government's liability. In other versions, liability limits of from $2.2 to 6.5 billion would be imposed. Any bill that would make the government fully liable for accidents by DOE contractors would likely be vetoed by the President.

3. *Indexing for inflation:* Some versions of the proposed Price-Anderson Act extension include provisions for automatically indexing the liability limits to inflation, perhaps every five years. Any indexing that would increase the limits over time is strongly opposed by the nuclear industry.

Conclusion

The viewpoint of the nuclear industry concerning the Price-Anderson Act has been one of caution, especially after the accident at Chernobyl. The single best argument in favor of low liability limits, one stressing the nuclear industry's safety record, suddenly lost much of its force. The industry clearly hopes for a low limit on liability and opposes indexing for inflation, but there seems little point in fighting for the lowest possible figure while the Chernobyl disaster still affects most nuclear-related issues before Congress.

Groups opposed to nuclear power also would not be entirely satisfied with a $6.5 billion limit on liability, even though it would represent an increase of nearly ten times the present limit. Many of these groups support unlimited liability or limits well above $6.5 billion, citing studies that estimate the potential damages from a major accident near a heavily populated area at up to $300 billion.

Congress has now adjourned until January 1987 without voting on a Price-Anderson Act extension or amendment. It seems likely that the Act will reappear before the next Congress in essentially the same form, although perhaps focusing on the issue of coverage for DOE contractors rather than on the issue of liability limits for commercial plants. In any event, nearly all parties are agreed on the desirability of extending the Price-Anderson Act.

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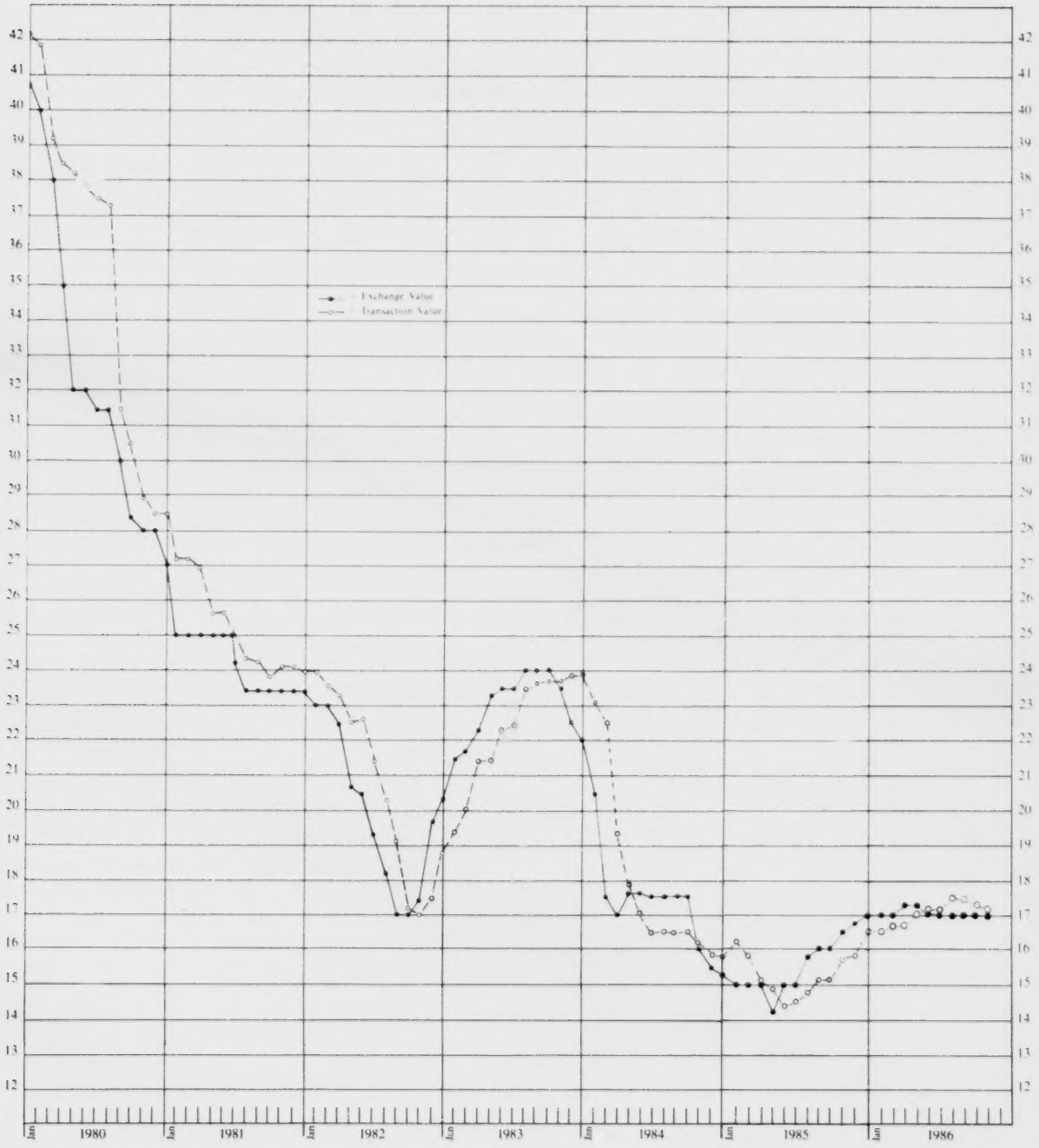
HISTORICAL MARKET DATA

EXCHANGE AND TRANSACTION VALUES
SINCE JANUARY 1980

Determined as of the last day of the month indicated



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HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	6.35	6.35	6.40	6.45	6.50
1969	—	6.35	6.10	6.10	6.25	6.25	6.20	6.20	6.15	6.15	6.15	6.20
1970	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.20	6.15	6.15	6.15	6.15
1971	6.20	6.20	6.20	6.20	6.15	6.05	6.00	5.95	5.95	5.95	5.95	5.95
1972	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
1973	5.95	6.00	6.10	6.20	6.45	6.50	6.50	6.50	6.50	6.50	6.75	7.00
1974	7.70	7.90	8.00	9.00	9.50	10.50	11.50	12.00	12.50	14.00	14.75	15.00
1975	16.00	16.00	18.00	20.00	21.00	23.00	24.70	26.00	26.00	28.50	30.00	35.00
1976	32.50	37.00	39.25	40.00	40.00	40.00	40.00	40.40	41.00	41.00	41.50	41.00
1977	41.35	41.50	41.60	41.60	42.00	42.25	42.25	42.25	42.40	42.75	43.20	43.20
1978	42.90	43.25	43.25	43.25	43.40	43.40	43.40	43.10	43.25	43.00	43.25	43.25
1979	43.25	43.25	43.25	43.25	43.25	43.00	42.70	42.70	42.20	42.20	41.00	40.75
1980	40.00	38.00	35.00	32.00	32.00	31.50	31.50	30.00	28.50	28.00	28.00	27.00
1981	25.00	25.00	25.00	25.00	25.00	24.25	23.50	23.50	23.50	23.50	23.50	23.50
1982	23.00	23.00	22.50	20.75	20.50	19.25	18.25	17.00	17.00	17.50	19.75	20.25
1983	21.50	21.75	22.25	23.25	23.50	23.50	24.00	24.00	24.00	23.50	22.50	22.00
1984	20.50	17.50	17.00	17.75	17.75	17.50	17.50	17.50	17.50	16.00	15.50	15.25
1985	15.00	15.00	15.00	14.25	15.00	15.00	15.75	16.00	16.00	16.50	16.75	17.00
1986	17.00	17.00	17.25	17.25	17.00	17.00	17.00	17.00	17.00	**17.00**		

HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	—	—	—	—	39.60	39.70	39.70	40.40	40.30	40.60	40.70	40.70
1977	41.30	41.30	41.40	41.50	42.80	42.90	43.00	42.60	42.50	42.80	42.90	42.90
1978	43.10	43.30	43.70	43.60	43.60	43.20	43.30	43.40	43.40	43.60	43.40	43.70
1979	43.60	43.80	43.70	43.40	43.60	43.70	43.70	43.60	43.60	43.60	43.50	42.30
1980	42.00	39.30	38.60	38.40	37.90	37.60	37.30	31.60	30.60	29.00	28.70	27.70
1981	27.20	27.20	27.00	25.70	25.70	24.50	24.40	24.30	23.90	24.10	24.10	24.00
1982	24.00	23.70	23.40	22.60	22.70	21.50	20.30	19.10	17.30	17.00	17.55	18.80
1983	19.35	20.00	21.35	21.40	22.35	22.45	23.50	23.60	23.65	23.65	23.85	23.85
1984	23.05	22.50	19.25	17.90	17.00	16.50	16.60	16.40	16.55	16.05	15.90	15.90
1985	16.20	15.70	15.05	14.90	14.45	14.60	14.75	15.10	15.10	15.75	15.80	16.55
1986	16.55	16.70	16.70	17.10	17.15	17.20	17.50	17.45	17.35	**17.25**		

HISTORICAL CONVERSION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U in UF_6)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1981	1.20	1.20	1.20	1.40	1.15	1.15	1.15	1.10	1.10	1.10	1.20	1.20
1982	1.20	1.20	1.20	1.20	1.00	1.00	1.00	0.90	1.10	1.60	1.45	1.45
1983	1.20	1.40	1.40	1.20	1.20	1.20	1.10	1.10	1.00	0.60	0.60	0.60
1984	0.60	0.30	0.80	0.80	0.80	0.00	0.00	0.80	1.00	1.00	0.80	0.80
1985	1.00	1.00	1.00	1.50	1.50	1.60	1.60	1.60	1.60	1.60	1.60	1.60
1986	1.60	1.80	1.80	1.90	1.80	1.80	1.80	1.90	1.90	**1.90**		

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GOVERNMENT STATISTICS

AUSTRALIA

	Price Index of Materials Used in Manufacturing Industry — All Groups[1] (1984 = 100)	Award Rates of Pay Indexes Australia — Adult Males In Mining Wage Earners, Weekly Rates[2] (1976 = 100)
1975 Avg.	150.4	132.6
1976 Avg.	168.4	160.9
1977 Avg.	192.0	179.0
1978 Avg.[3,4]	198.5	190.0
1979 Avg.	248.8	127.9
1980 Avg.	321.8	140.8
1981 Avg.	355.3	154.1
1982 Avg.[5]	368.6	174.9
1983 Avg.	401.6	181.8
FY84 Avg.[6]	95.3	—
FY85 Avg.[6]	100.0	—
Jan 1985	97.0	197.8
Feb 1985	98.6	197.8
Mar 1985	102.1	197.8
Apr 1985	104.4	202.8
May 1985	107.6	202.4
Jun 1985	108.7	202.4
Jul 1985	111.1	202.4
Aug 1985	110.5	202.4
Sep 1985	108.7R	202.5
Oct 1985	108.4R	202.4
Nov 1985	109.4R	209.9
Dec 1985	110.0R	210.0
Jan 1986	109.6R	210.0
Feb 1986	108.7R	210.0
Mar 1986	99.5R	210.5R
Apr 1986	94.3R	210.5R
May 1986	93.5R	210.5R
Jun 1986	95.7R	210.5R
Jul 1986	98.1	215.2R
Aug 1986	—	215.2

P = Preliminary R = Revised since last month

[1]Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0). The basis of this index was revised to 1984 = 100. The previous index was 1969 = 100.

[2]Australian Bureau of Statistics, Canberra: "Award Rates of Pay Indexes, Australia" (Catalogue No. 6312.0). Figures for the latest fourteen months shown are subject to revision.

[3]Monthly data for 1970-78 appear on pages 4.7 and 4.8 of Report 138.

[4]Annual averages prior to 1979 reflect index base no longer in use.

[5]Monthly data for 1979-82 appear on page 35 of Report 184.

[6]Annual averages are for financial year ending June 30.

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CANADA

	Industry Selling Price Index: All Commodities[1] (1981 = 100)	Wage-earner Data: Average Hourly Earnings (C$)[2]					
		Uranium Mines (SIC 057)	Metal Mines (SIC 051-059)	Mines, Quarries and Oil Wells[3] (SIC 051-099)	Primary Non-ferrous Metal Industries[4] (SIC 296)	(SIC 298)	Chemicals and Chemical Products[5] (SIC 372-379)
1979 Avg.[6]	217.9	—	9.60	9.66	—	—	7.67
1980 Avg.	247.2	—	10.58	10.80	—	—	8.50
1981 Avg.	288.7	—	12.02	12.23	—	—	9.53
1982 Avg.[7]	288.8	—	13.74	13.92	—	—	10.63
1983 Avg.	298.8	—	—	14.30	—	—	11.17
1984 Avg.	310.9	17.88	—	15.07	12.28	10.49	11.76
Jan 1985	117.5	18.05	16.13	15.60	12.32	10.80	12.04
Feb 1985	117.7	18.78	16.41	15.68	12.52	11.05	12.06
Mar 1985	118.4	18.24	16.21	15.57	12.44	10.97	12.02
Apr 1985	118.3	18.63	16.44	15.80	12.81	11.23	12.04
May 1985	118.6	19.41	16.51	15.63	12.76	11.25	12.15
Jun 1985	118.6	18.49	16.20	15.49	12.89	11.14	12.14
Jul 1985	118.6	18.14	16.27	15.41	12.96	11.17	12.13
Aug 1985	118.4	17.07	16.03	15.30	12.97	11.31	12.19
Sep 1985	118.6	18.53	16.55	15.72	12.95	11.39	12.26
Oct 1985	119.0	18.74	16.51	15.70	13.14	11.53	12.33
Nov 1985	119.3	19.05	16.66	15.88	12.76	11.32	12.49
Dec 1985	120.0	19.07	16.57	16.01	12.51	11.09	12.59
Jan 1986	121.0	18.15	16.22	15.86	13.11	11.48	12.52
Feb 1986	120.8	19.52	16.57	15.99	13.20	11.59	12.45
Mar 1986	120.1	19.04	16.65	15.93	13.11	11.59	12.54
Apr 1986	119.4	19.38	16.68	15.95	13.07	11.64	12.54
May 1986	118.5R	19.54	16.68	15.78	13.16	11.72	12.51
Jun 1986	118.7R	19.80	16.63	15.64R	13.44R	11.86R	12.49R
Jul 1986	118.7R	19.51	16.34	15.48	13.28	11.73	12.52
Aug 1986	119.1P	18.96P	16.13P	15.40P	12.97P	11.78P	12.74P

P = Preliminary R = Revised since last month

[1]Statistics Canada, Prices Division, Ottawa: "Industry Price Indexes" (Catalogue 62-011). Indexes for the most recent six months shown are subject to revision. This category was formerly known as "Manufacturing." Index prior to 1985, 1971 = 100.

[2]Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa: "Employment, Earnings and Hours" (Catalogue 72-002).

[3]Reports 175 through 185 list this series title incorrectly as "Metal Mining, Including Milling (SIC 050-099)."

[4]Beginning with the April 1983 figure, Primary Metal Industries, non-ferrous is split into SIC 296 and SIC 298.

[5]Chemical and Chemical Products prior to April 1983 was SIC 370-379. The new series is from a new survey which includes all companies and is based on a 1970 classification. The old survey only included companies of 20 employees or more.

[6]Monthly ISPI for 1977 and 1978 appear on page 4.10 of Report 138, and monthly wage-earner data for 1973-78 appear on page 4.11 of Report 138.

[7]Monthly data for 1979-1982 appear on page 37 of Report 184. On that page, the wage earner index entitled "Metal Mining, Including Milling (SIC 050-099)" should read "Total Mining (SIC 051-099)."

[8]Beginning with the March 1983 figure, Wage Earner Data are based on a census of all companies employing 200 or more wage earners, *plus* a random survey of companies employing fewer than 200 wage earners. Prior to March 1983 only companies employing 200 or more wage earners are included in the Wage Earner Data.

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GOVERNMENT STATISTICS

REPUBLIC OF SOUTH AFRICA

		Average Declared Working Costs per Metric Ton of Gold Ore Milled (Rand)[1]	Tonnage-Weighted Index of Average Working Costs per Metric Ton of Gold Ore Milled (March 1982 = 100)[2]	Consumer Price Index[3] (1980 = 100)[4]	Producer Price Index All Groups[5] (1980 = 100)	Total Employment in Mining and Quarrying (Code 35)[6]	Total Salaries and Wages in Mining and Quarrying (1,000 Rand) (Code 40)[6]
1975	Avg.	16.71	—	157.2	100.0	639,473	1,003,617
1976	Avg.	19.30	—	174.7	115.1	671,240	1,212,983
1977	Avg.	23.87	—	194.4	130.0	712,006	1,420,670
1978	Avg.	27.14	—	137.2	142.7	664,571	1,537,169
1979	Avg.[7]	30.18	—	155.3	164.5	692,209	1,830,632
1980	Avg.[8]	35.53	—	176.7	192.1	714,379	2,279,615
1981	Avg.	41.89	—	206.5	218.3	728,506	2,820,505
1982	Avg.[9]	47.25	104.2	233.5	248.7	707,552	3,246,071
1983	Avg.	51.87	115.0	262.2	274.8	696,579	3,644,772
1984	Avg.	58.95	130.3	292.8	297.9	712,080	4,196,764
Jan	1985	—	—	177.1	166.6	711,366	376,777
Feb	1985	—	—	182.8	171.3	727,932	361,823
Mar	1985	64.48	142.4	183.6	173.0	708,809	371,380
Apr	1985	—	—	187.4	174.0	724,187	369,005
May	1985	—	—	189.5	177.7	708,085	373,478
Jun	1985	67.42	148.9	191.9	179.2	724,587	395,543
Jul	1985	—	—	193.6	180.7	738,228	419,106
Aug	1985	—	—	195.6	183.2	734,121	416,777
Sep	1985	70.47	155.3	197.8	184.8	732,836	419,883
Oct	1985	—	—	200.8	188.1	720,071	401,448
Nov	1985	—	—	203.4	196.0	750,049	432,996
Dec	1985	72.43	160.1	207.4	199.4	741,372	425,261
Jan	1986	—	—	213.8	203.6	744,070	449,513
Feb	1986	—	—	215.8	206.9	754,458	438,562
Mar	1986	75.76	167.8	218.3	206.9	759,897	445,387
Apr	1986	—	—	222.2	208.9	756,388	437,563
May	1986	—	—	222.6	212.5	754,788	425,544
Jun	1986	77.65	172.0	224.4	213.3	756,637R	462,365R
Jul	1986	—	—	228.8	216.3	765,915	520,983
Aug	1986	—	—	232.2	220.3	—	—
Sep	1986	81.94P	181.8	236.7	—	—	—

[1]Chamber of Mines of South Africa, Johannesburg; "Analysis of Working Results," published quarterly.

[2]Page 16 of Report 178 contains description and calculation of index, and page 24 of Report 178 lists figures for 1982.

[3]Republic of South Africa Department of Statistics, Pretoria, "Government Gazette: Consumer Price Index for Urban Areas."

[4]The basis for calculation prior to January 1985, 1975 = 100. For annual averages prior to 1978, April 1970 = 100.

[5]Previously known as the Wholesale Price Index, now the Producer Price Index. The computation remains the same. The basis for calculation prior to January 1985, 1975 = 100.

[6]Bulletin of Statistics, Department of Statistics, Pretoria.

[7]Historical data for the Average Declared Working Costs and Consumer Price Index 1970-1979 appear on page 4.9 of Report 140.

[8]Monthly data for Codes 35 and 40, 1977-1980, appear on page 28 of Report 157.

[9]Monthly data for 1979-82 appear on page 39 of Report 184.

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UNITED STATES

	Producer Price Index[1]		Consumer Price Index[2]	GNP Implicit Price Deflator[3,4]	Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$)[5]			
	Industrial Commodities (1967 = 100)	All Commodities (1967 = 100)	(1967 = 100)	(1982 = 100)	Metal Mining (SIC 10)	Primary Non-ferrous Metals (SIC 333)	Chemicals and Allied Products (SIC 28)	Electric and Electronic Equipment (SIC 36)
1980 Avg.[6]	274.8	268.8	246.8	178.64	10.26	10.63	8.30	6.94
1981 Avg.	304.1	293.4	272.4	195.51	11.55	11.98	9.12	7.62
1982 Avg.[7]	312.3	299.3	289.1	207.15	12.33	12.94	9.96	8.21
1983 Avg.	315.8	303.1	298.4	215.63	12.57	13.43	10.59	8.65
1984 Avg.	322.6	310.3	311.1	108.1	13.05	13.43	11.08	9.04
Jan 1985	322.9	309.5	316.1	—	13.29	13.70	11.39	9.33
Feb 1985	322.5	309.2	317.4	—	13.30	13.73	11.39	9.33
Mar 1985	322.6	308.7	318.8	110.4	13.29	13.95	11.37	9.39
Apr 1985	323.8	309.3	320.1	—	13.43	13.63	11.47	9.40
May 1985	325.3	309.8	321.3	—	13.24	13.60	11.44	9.39
Jun 1985	324.8	309.2	322.3	111.3	13.23	13.68	11.51	9.46
Jul 1985	324.4	309.0	322.8	—	13.45	13.83	11.59	9.47
Aug 1985	323.7	307.3	323.5	—	13.55	13.71	11.60	9.50
Sep 1985	322.3	305.5	324.5	112.1	13.44	13.68	11.65	9.54
Oct 1985	324.2	307.9	325.5	—	13.49	13.66	11.70	9.55
Nov 1985	324.7	309.5	326.6	—	13.49	13.97	11.80	9.61
Dec 1985	325.1	310.2	327.4	113.0	13.43	13.81	11.85	9.68
Jan 1986	323.8	308.9	328.4	—	13.40	13.69	11.86	9.60
Feb 1986	318.9	304.4	327.5	—	13.44	13.82	11.81	9.60
Mar 1986	314.0	300.3	326.0	113.5	13.38	13.93	11.78	9.62
Apr 1986	311.6	298.2	325.3	—	13.54	13.87	11.82	9.62
May 1986	311.6R	299.2	326.3	—	13.46	13.79	11.89	9.64
Jun 1986	311.6	298.9	327.9	114.2	13.52	13.49	11.94	9.61
Jul 1986	308.5	297.7	328.0	—	13.47	13.22	12.04R	9.63
Aug 1986	307.7	297.2	328.6	—	13.14P	13.25P	11.98R	9.67R
Sep 1986	308.8	297.7	330.2	115.0P	—	—	12.03P	9.74P

P = Preliminary R = Revised since last month

[1]US Bureau of Labor Statistics, Washington, D.C.: "Producer Prices and Price Indexes," (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents.

[2]US Bureau of Labor Statistics, Washington, D.C.: Consumer Price Index for All Urban Consumers, US City Average, All Items.

[3]US Department of Commerce, Washington, D.C.: Bureau of Economic Analysis, National Income and Wealth Division: "Survey of Current Business." The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted.

[4]The basis for calculation of this index was revised to 1982 = 100. 1984 and 1985 figures have been adjusted to that basis. The basis for calculation prior to 1984, 1972 = 100.

[5]US Bureau of Labor Statistics, Washington, D.C.: "Employment and Earnings." All data based on 1972 revision of SIC Manual. Data for 1970-1976 are adjusted to the March 1977 benchmark. Data for 1977-1978 are adjusted to the March 1979 benchmark. Data for January 1979 and beyond are adjusted to the March 1980 benchmark.

[6]Monthly data 1970-1978 for Producer Price Index-Industrial Commodities, Consumer Price Index, and Employment and Earnings SIC codes 10, 333, and 28, and quarterly data for GNP Implicit Price Deflator appear on pages 4.6-4.8 of Report 139.
Monthly data 1977-1978 for Employment and Earnings SIC Codes 10, 333, and 28 appear on page 33 of Report 147.
Monthly data 1970-1978 for Employment and Earnings SIC Code 36 appear on page 23 of Report 154.
Monthly data 1977-1980 for Producer Price Index-All Commodities, appear on page 21 of Nuexco Report 158.

[7]Monthly data 1979-1982 for all listed indices appear on page 41 of Report 184.

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